JUNE 1927—THIRTY-THIRD YEAR

MACHINERY

THE INDUSTRIAL PRESS Publishers. 140-148 LAFAYETTE ST., NEW YORK

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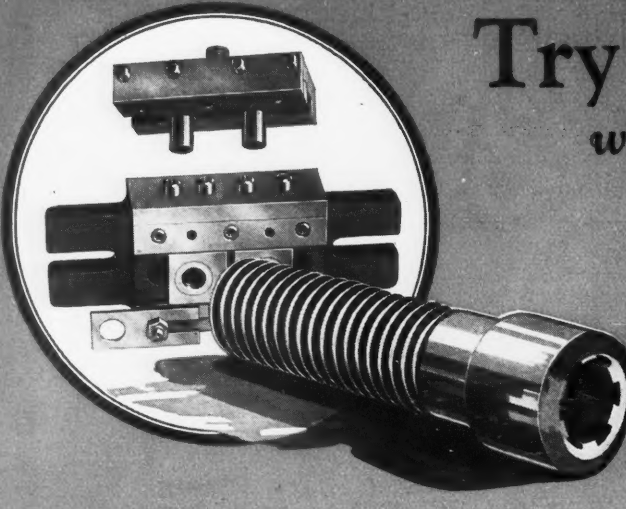

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In punch and die work and other jobs that are hard on cap screws, Bristos demonstrate their great holding capacity, strength and wearing qualities. Made for the toughest job, Bristo Cap Screws can be relied upon for *every* job.

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Cap Screw Bulletin 821-E explains how the unique dovetailed flute socket works. Write The Bristol Co., Waterbury, Conn. Sample screws, if you wish.

[Bristo hollow safety set screws, including a series of nine diameters less than ¼ inch, all have the Bristo dovetailed flute socket design. Ask for bulletin 820-E.]

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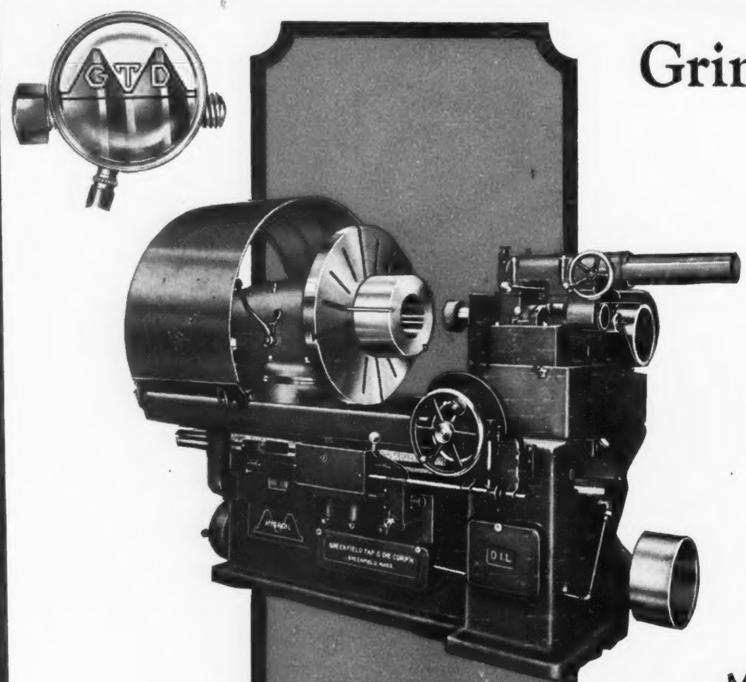

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The finishing of cored or bored holes up to 32½ inches in diameter, on pieces up to 48 inches in diameter, can now be handled by grinding.

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Lower Hole Costs

Since the earliest days of metal working, there were always holes to be drilled; and today there are few mechanisms in the manufacture of which the drilling of holes is not an important operation.

The builders of drilling machines are among the most progressive manufacturers of machine tools, and always have kept in advance of the demand for economical "production of holes." The twist drill manufacturer and the drilling machine builder have developed a powerful combination that turns metal into chips at a speed which amazes the onlooker who still has some drilling machines in his shop ten years old. Not long ago drilling speeds of 35 feet per minute were considered all that machine and drill could stand; 170 feet per minute is common practice today.

The powerful heavy-duty drilling machines, the high-speed sensitive types, and the multiple designs for drilling from one to four sides at a time are all great mechanical developments, chiefly because they greatly reduce drilling costs.

Two modern drilling machines recently replaced five less efficient designs and reduced the drilling time to one-tenth of the time formerly required. The cost of this new equipment—$9000—was saved in less than 5 months. Another modern machine cut drilling costs in half, and similar examples of large savings are common in well equipped shops.

If you keep a record of your drilling costs, it will be easy to determine how much you can save in a year should you replace the obsolete drilling machines in your plant.

A Trip Through a Clock Factory

Some of the Unusually Interesting Operations Seen During a Visit to the Seth Thomas Clock Co.

By CHARLES O. HERB

THOUSANDS of years intervened between the period when men commenced to divide time and the period when satisfactory means of keeping time were devised. Chaldean astronomers, 4000 years ago, marked the path of the sun through the heavens by the signs of the Zodiac and thus established the twelve lunar months. They also divided the months into days and the days into hours and minutes. With the exception of a few improvements made to increase its accuracy, their calendar is ours.

Years were measured by astronomical observations, but the measurement of parts of a day was a difficult problem. Sun dials were used by the Chaldeans and have been used down through the ages until the coming of the modern clock. When used in latitudes for which they were built, sun dials were fairly satisfactory except on cloudy days, but they always became useless at sundown. Water clocks were also famous ancient time-keepers, but outside of kings' palaces and the homes of the wealthy, the hour glass was the most common time measuring device for thousands of years.

Records of the Medieval Ages do not tell definitely when clocks (as the term is now applied) were invented. It is known, however, that clocks operated by wheel-and-pinion mechanisms existed in various church towns of England, France, and Germany in the Thirteenth and Fourteenth Centuries. Accurate clocks appeared by the end of the Seventeenth Century, but even during the Eighteenth Century, clocks were within the reach of the rich only.

A Connecticut Yankee Instituted Manufacturing Methods

One of the ships that carried from England those historic cargoes of tea that were dumped into Boston harbor in 1773 also brought to this country an English clock-maker by the name of Thomas Harland. Mr. Harland went into business in Norwich, Conn., and taught the art of clock-making to many apprentices. As a result, more clocks are manufactured in Connecticut today than in all the rest of the United States.

One of Harland's apprentices was a lad named Eli Terry who made his first clock in 1792. By 1807 Terry had established a small factory in Plymouth, Conn., and had an order on hand for 1000 clocks. By making clocks in comparatively large quantities, Terry succeeded in bringing them within the reach of families of moderate means. He is justly called the "Father of American Clock-making."

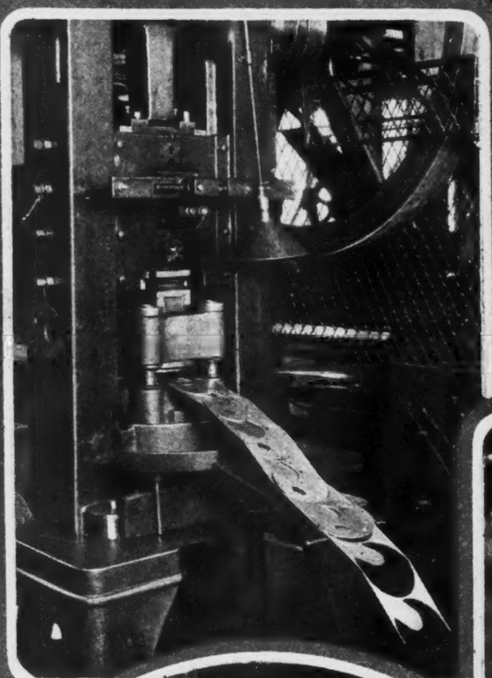
For a few years Terry had two partners—Seth Thomas and Silas Hoadley—but by 1813, each of the three partners was in business for himself. Seth Thomas founded a business in Plymouth that has been managed and controlled by his descendants ever since in the same town, although the town was renamed "Thomaston" in 1859. There have been four presidents of the Seth Thomas Clock Co. since the concern was incorporated in 1853. Each of these presidents has been a direct descendant of the founder.

Knowing that there would be much of unusual interest to MACHINERY'S readers at the factory of the Seth Thomas Clock Co., the writer recently made a trip there, and in this article, will describe some of the many things seen.

Clocks Comprise Several Hundred Parts

"How many parts are there in the average clock?" is a question that will come to the minds of many. There are approximately 125 "parts," as the term is used in this plant, but in many cases

(Above) Fig. 1. New Styles of Clocks are Constantly being Developed in the Model Room



(Left) Fig. 2. With Each Stroke this Press Pierces, Stamps, and Blanks Frame Parts

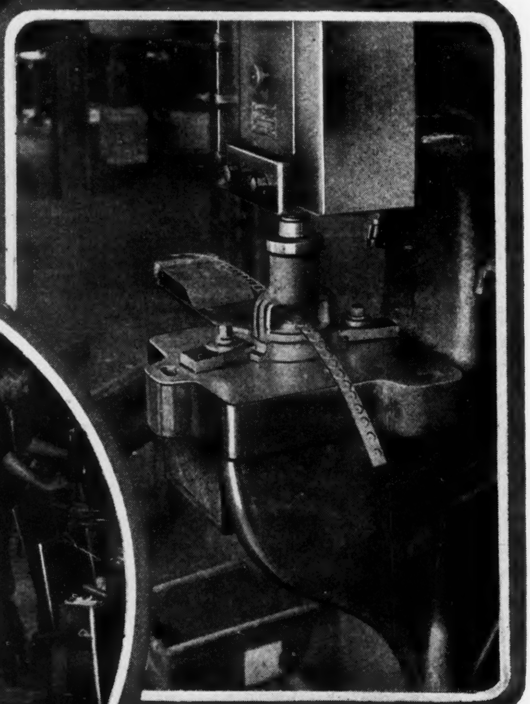


Fig. 3. By the Use of a Sub-press Die this Machine Produces Cams of Extreme Accuracy

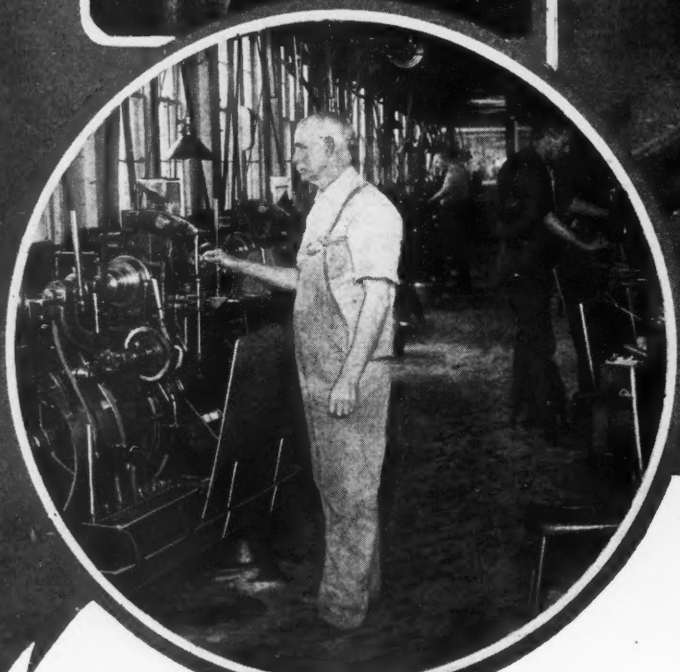
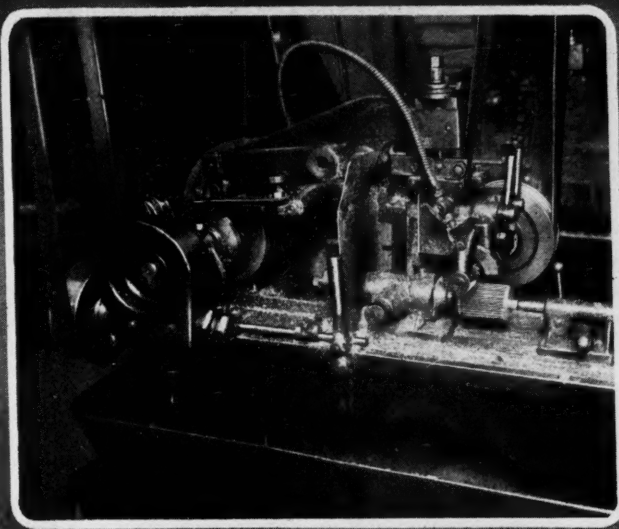
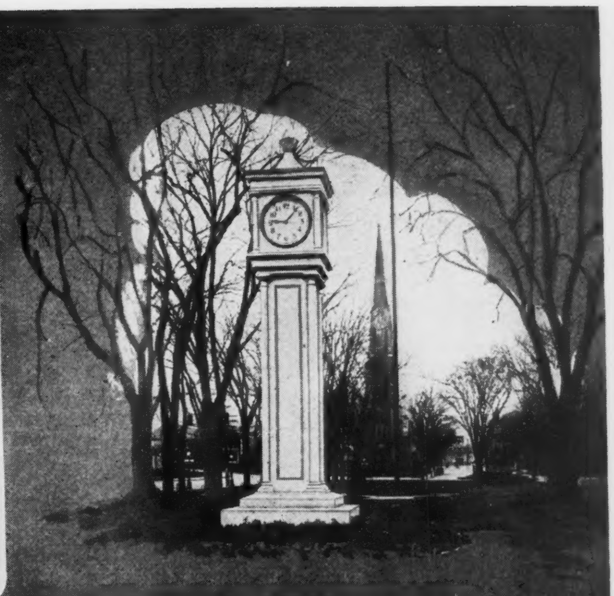
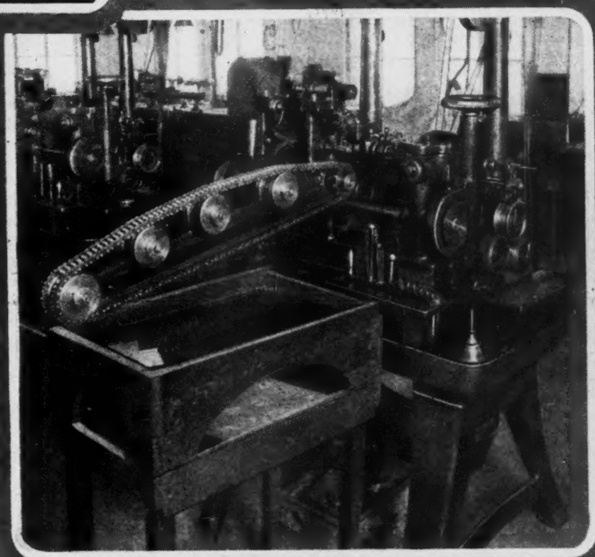


Fig. 4. Automatic Machines Produce Many Kinds of Parts by the Thousand





(Above) Fig. 5. For Milling Gear Teeth, a Large Number of Blanks are Held on an Arbor at One Time



(Right) Fig. 6. Seven Holes are Drilled Successively in a Part By the Use of this Automatic Machine

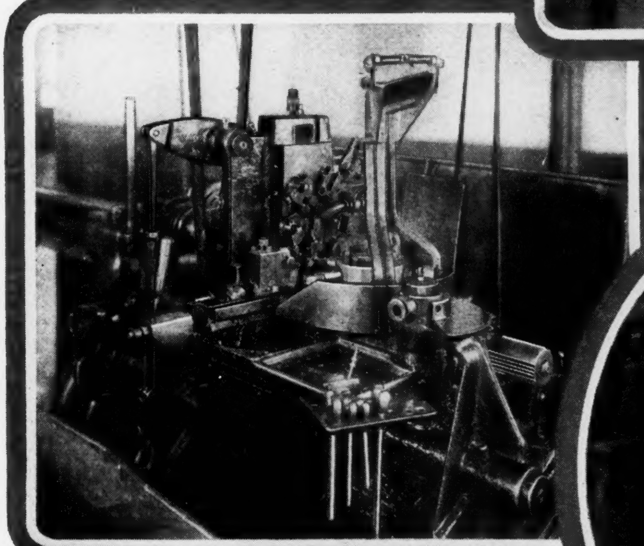


Fig. 7. A Machine that Assembles Small Collars on a Bar, and also Takes Facing and Turning Cuts

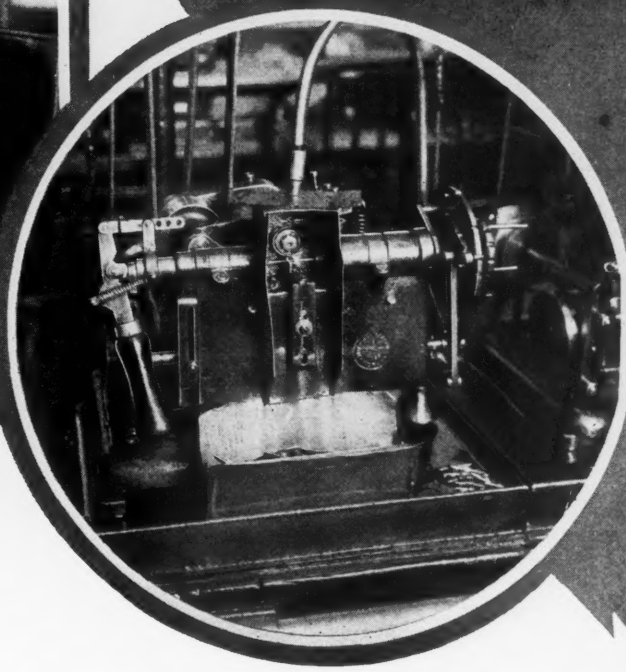


Fig. 8. Pinion Teeth are also Milled in an Automatic Machine

two or three separate pieces make up one "part." There are probably 350 pieces in the average clock. About 600 different factory operations are performed on the parts for one clock. Many parts are interchangeable in the different styles of clocks, but over 300 styles are made, and to cover all of these, it is necessary to produce approximately 10,000 different parts. The parts are assembled into forty varieties of movements and 125 varieties of cases.

Large stores of raw materials must always be kept on hand to meet the demands of the factory. Over 500 main items are purchased regularly, and these are sub-divided into approximately 6000 different sizes, shapes, and grades of materials. The principal materials are brass, steel, iron, glass, wood, and shellac. Supplies are ordered as the quantity of each material on hand is reduced to a certain point.

Clock Engineering Starts with Model-making

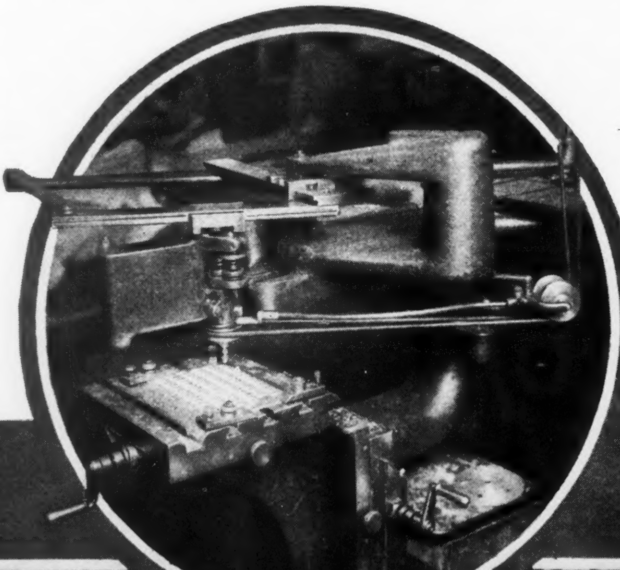
Unlike the procedure usually followed in the manufacture of both large and small machinery, clock engineering begins with the making of models. Working drawings of the various parts are made after the models have proved satisfactory. A committee of design decides upon the production of new styles of clocks and sends sketches with general specifications to the model room, a corner of which is shown in Fig. 1. In this room the various parts are made up and assembled. The working drawings later made for regular shop production are often five times the actual size of the part portrayed, whereas drawings of small screws, etc., may be thirty times the actual size.

High-grade workmanship is obviously necessary in the model room, and the men employed there are expert instrument makers. The man in the foreground of the illustration has been with the company over forty-five years, forty years of which he has spent in the model room. The first man to his left has been in the room for twenty-five years. Bench lathes, drilling machines, pinion and gear cutting machines, and grinders comprise part of the equipment.

All clock movements consist primarily of four groups of parts—a driving mechanism, transmitting mechanism, controlling mechanism, and indicating mechanism. Either a weight or spiral spring furnishes the driving power, and this force is transmitted through gears and pinions, the drive being always from a gear to a pinion. The controlling mechanism consists of the pendulum, verge, and escape wheel, the last wheel in the transmitting mechanism driving a pinion on the shaft of the escape wheel. The dial, hands, and "under-the-dial" parts comprise the indicating mechanism. Every clock is so constructed that a shaft in the center of the clock makes one revolution per hour.

One of the most important parts of a clock is the verge, as this part transmits energy to the indicating mechanism and also prevents the escape wheel which drives it from running too fast. Two angular surfaces on opposite ends of the verge come in contact alternately with the teeth of the escape wheel.

Fig. 9. Numerals and Other Pieces of Irregular Outline are Often Produced with this Pantograph Machine



(Below) Fig. 10. Lathe Used in Cutting Two Hundred Screws per Foot of Wire

(Below) Fig. 11. Turning and Facing Parts with an Unusual Hand Tool

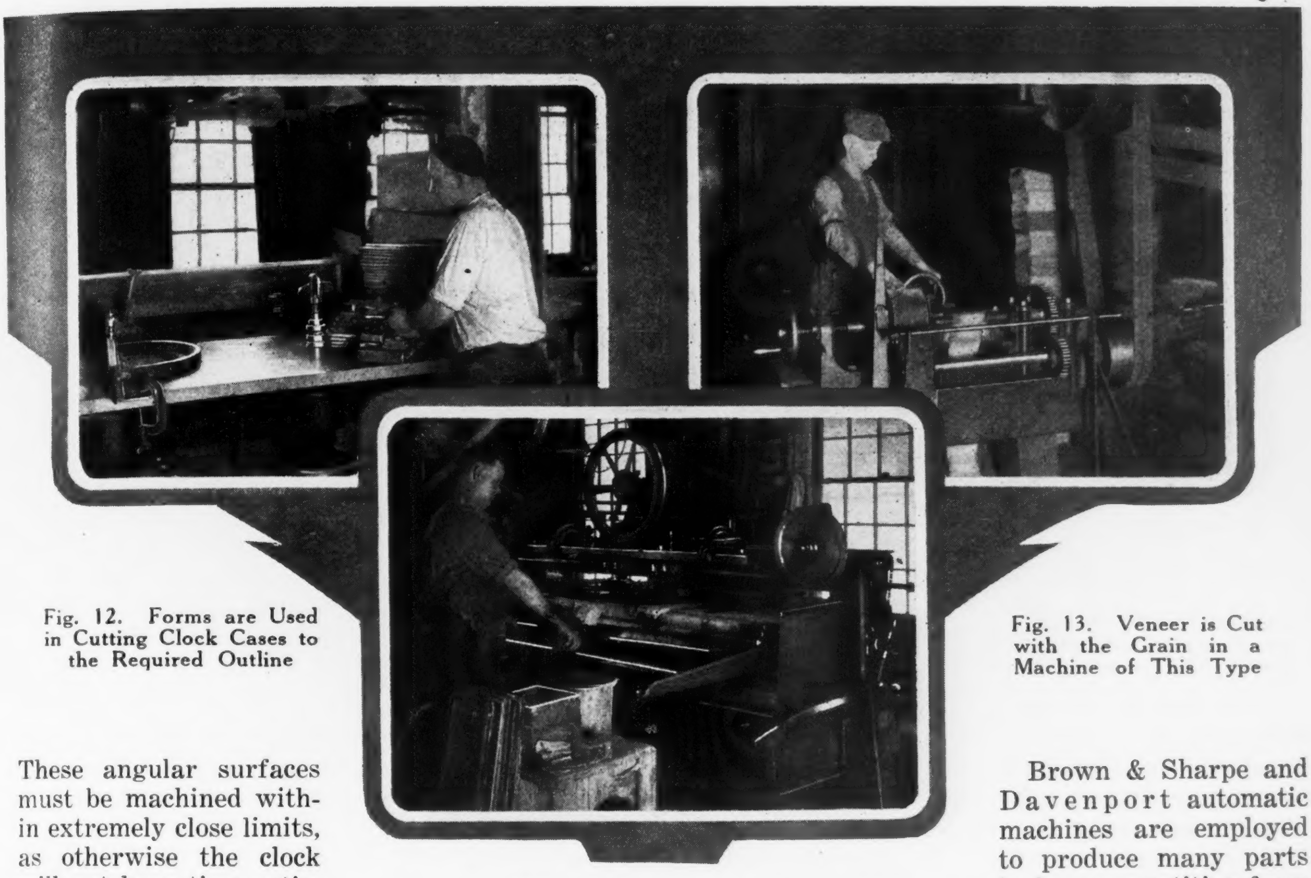


Fig. 12. Forms are Used in Cutting Clock Cases to the Required Outline

Fig. 13. Veneer is Cut with the Grain in a Machine of This Type

Fig. 14. The Varnish of Flat Boards is Rubbed Down in a Reciprocating Type of Machine

These angular surfaces must be machined within extremely close limits, as otherwise the clock will not keep time satisfactorily. On some high-grade clocks, sapphire jewel plates are mounted on these angular surfaces to reduce the wear.

In addition to the mechanisms mentioned, a clock generally has a separate striking attachment, and there may be chime, alarm, and other attachments. The striking mechanism consists of a power-furnishing spring or weight, a train of wheels, a regulator, a device for starting the striking at the proper time, and a device that causes the proper number of blows to be struck.

Power Presses are Used Extensively

Many parts such as dials, gears, frames, and hands are blanked from brass and steel in power presses of various types. Frequently piercing and stamping are performed at the same time as blanking. Some of the presses are equipped with sub-press dies to enable the parts to be produced with great accuracy. Gears are not completely finished in power presses, all teeth being produced by milling.

Frame parts having fifteen pierced holes ranging from 1/16 to 1/4 inch in diameter and having letters, numbers, a trademark, and the firm's name stamped at five different points are pierced, stamped, and blanked simultaneously at one stroke of the press illustrated in Fig. 2. The stock used is 0.072 inch tempered brass. Fig. 3 shows a machine equipped with a sub-press die for producing hammer cams used in chime movements. These cams have four small projecting prongs and three pierced holes. They must be true within extremely close limits or else the chimes of the clocks in which the cams are assembled will not be harmonious.

Brown & Sharpe and Davenport automatic machines are employed to produce many parts in large quantities from bar stock. Some of these machines, in addition to taking various cuts on the bar, also assemble other pieces on the bar. Fig. 7 illustrates a Davenport machine. The turret is equipped with two magazines which successively align two brass collars with the steel bar. Each of these collars is forced on the bar as the turret advances toward the headstock.

Turning and facing cuts are taken on the bar and on the collars and the finished piece is finally cut off. Altogether, there are fourteen different steps or operations in each cycle of the machine, tools being located on the turret, the indexing head, and the cross-slide. A hole slightly smaller in diameter than the bar is drilled through each collar previous to its being placed in the magazine, and thus the collars are held securely after they have been forced on the bar. The bar is only 0.096 inch in diameter. Most movement parts for high-grade clocks must be manufactured true within 0.002 inch of nominal dimensions.

Parts machined in the manner just described are later taken to Davenport machines of the type shown in Fig. 6. The parts are loaded on a chain conveyor which carries them to fingers that pick them off the conveyor, one by one, and transfer them to the center of the machine. Here the shank of each part is entered in a collet chuck and seven holes 0.029 inch in diameter, are drilled, one at a time, through one collar and part way into the second collar. The work is indexed and the drill spindle returned between the drilling of each hole. In a later hand operation, small wires are inserted into these holes to span the space between the two collars. These wires are cut off and peened over at one end to hold them in place. The unit then

Fig. 15. Assembly Operations without End are Required in Putting the Movements Together

forms a lantern pinion, the wires functioning in the same manner as ordinary pinion teeth.

All Gear and Pinion Teeth are Milled

Thirty or more gear blanks are mounted at one time on an arbor for milling the teeth in Bilton machines of the design shown in Fig. 5. The milling cutter is mounted on a head which is fed slowly to the right over the work to cut the teeth, then raised slightly, and returned quickly to the left of the work. During the return stroke of the cutter-head, the work is indexed one tooth. The teeth are milled to the entire depth at one pass of the cutter. In the case of the work illustrated, the blanks are 1.995 inches in diameter and sixty teeth are cut around their periphery, which means that the circular pitch is only approximately 1/32 inch. Most gear and pinion teeth are of standard epicycloidal type.

Pinion teeth are milled on Waltham machines of the design shown in Fig. 8. The pinion spindle is held in a collet at each end, and the teeth are cut as the work is fed from right to left past the cutter. At the end of each cutting stroke, the cutter is raised until the work has made the return stroke and indexed ready for cutting the next tooth. One pinion is finished per minute in this machine. A girl tends to four of these machines mounted on one table. She sits on a chair provided with rollers that run on a floor track. The chair is easily pulled from machine to machine as the girl grasps a rod which extends along the front of the table. Many operations in the factory are performed by girls.

Two Hundred Screws are Cut Per Foot of Wire

Screws so small that the thread can hardly be distinguished by the naked eye are turned, threaded, and cut off in the bench lathe seen in Fig. 10. Various sizes of screws are produced, the smallest measuring 0.051 inch long over all and having a shank only 0.025 inch in diameter by 0.033 inch long. The rated number of threads per inch is 200, and so the pitch is only 0.005 inch. The threads are cut by a minute steel die contained in a holder which is mounted in the tailstock and operated on and off the screw by hand. About 200 of these screws are cut per foot of wire, and there are approximately 45,350 screws to the pound, or over 2800 to the ounce. They are cut from wire 0.042 inch in diameter. A workman makes about 2000 screws of this size per day of nine hours.

Automatic machines are always used for manufacturing certain kinds of parts that are required in large quantities, but it would be uneconomical to use machines of this type for parts ordered in small lots. Innumerable pieces are therefore produced in small high-speed machines of the type shown in Fig. 11. The work is gripped by the headstock collet and supported by the center of the tailstock spindle. Bars such as are seen resting on the wooden stands in back of the machine, and which have tools extending from four sides, are used for taking all the facing and turning cuts on a part.

In operation, the round ends of these bars are supported on rests at the front of the machine and advanced against upright surfaces on the rests, the tools being set to cut to the required diameter as they come in contact with the upright surfaces. The men become dexterous in the use of these tools and turn out large quantities of work that must pass gage inspection. A long row of men are kept busy on work of this character.

There are many similar jobs throughout the factory that require highly skilled help. Hundreds of girls and men are engaged in the operation of miniature drilling machines and lathes. Several steps of unusual interest are performed in setting extremely small sapphires and rubies into jewel-bearing plates. Many special tools are produced and all tools reconditioned in a large tool-room. Power press dies are also made in this department.

When numerals of a special shape or size are required in small quantities, they are cut from sheet brass by means of the pantograph machine illustrated in Fig. 9. This equipment is also employed for producing large numerals when the quantity required is not sufficient to warrant making power press dies.

Every exposed brass part of a clock is buffed to a brilliant polish and then lacquered, or else plated

Fig. 16. A Final Assembly in the Manufacture of Chime Clocks

with gold, silver, or nickel. Many parts are enameled. All buffing, plating, enameling, and lacquering operations are performed in a large department furnished with modern equipment.

Assemblies are Performed Without End

The hundreds of parts that make up clock movements finally reach a large centralized assembling department, where rows and rows of men and girls are busily engaged in putting the parts together. A typical section of this department is shown in Fig. 15. Each person assembles several parts or units and then passes the movement to the next person. When the movements have been completely assembled, they are given a rigid test to insure that they keep time accurately. They are then sent to a separate department to be fitted into cases.

Clocks Must Be Ornamental as Well as Utilitarian

When a person considers buying a clock, particularly for use in a home, he considers its appearance fully as much as its ability to keep time accurately. Hence, most clocks must be ornamental as well as mere timekeeping instruments or machines. The Seth Thomas Clock Co. maintains a separate woodworking factory for manufacturing clock cases of attractive designs. The cases are generally made with a mahogany, walnut, or oak finish.

All lumber received for clock case construction is first thoroughly dried in kilns. Multifold operations are then performed in making the different sections of the large variety of cases, sanding and assembling these sections, and varnishing and rubbing down the complete cases.

Mahogany and walnut veneers are used in large quantities for the outer surfaces of the cases. White-wood veneer is also used in building up the curved top of the popular mantel models, the outer veneer of these tops being usually mahogany or walnut. All veneers are cut in the plant from square-section blocks of lumber, which are well steamed before being brought to the cutting machines.

A machine used in cutting veneer about 6 inches wide into lengths of 6 to 8 feet is shown in Fig. 13. The wood block is placed on centers in the machine and revolved. A shear blade somewhat longer than the block is then fed into the work at the proper rate to cut a continuous sheet of uniform thickness. The average veneer thickness is 1/32 inch. This machine is employed for cutting with the grain. Veneers are cut against the grain in an upright machine equipped with a long shear blade. Immediately after being cut, all veneer sheets are thoroughly dried in a steam press.

How Curved Tops are Built Up

In building up the curved tops of mantel clocks, the required number of sheets of white-wood veneer are glued together, and then a mahogany or walnut veneer is glued to the top side, sheets cut with the grain and against the grain being alternated. The glued unit is then clamped in a form of the desired shape until the glue has dried so thoroughly that the sheets of veneer will always adhere to each other and retain their curved outline.

Forms are used in rabbeting the fronts, backs, and doors of the cases. Fig. 12 illustrates such an operation on the front of a case. The piece of lumber is clamped in a form of the desired contour and then fed by hand past a cutter held on a revolving vertical spindle. Accuracy of outline is obtained by bringing the curved surface of the form in contact with the spindle directly beneath the cutter.

Careful attention is given to finishing the cases. After the parts have been sanded smooth, they are dipped into a stain, painted with filler, and given several coats of varnish. The varnish is finally rubbed down with pumice to remove the high gloss and obtain a high-grade appearance. Flat pieces are rubbed down by means of the machine illustrated in Fig. 14, which has two felt pads that are reciprocated under pressure the full length of the pieces. A sponge is used in applying a mixture of pumice and water to the pieces. The table is

traversed sidewise to permit the felt pads to reach every section of the work.

All Clocks are Tested for a Week

When the clock cases are finished, they are sent to an assembly department, where the movements are fitted into them and the dials, hands, and other parts added. Fig. 16 shows the section where the chime attachments are installed.

After the parts have been completely assembled in the cases, all the clocks are placed on shelves to be carefully regulated and inspected over a period of about a week. There are always several thousand clocks on the regulating shelves at one time. When all these clocks begin striking the hour, especially at noontime, the effect is startling, to say the least.

The degree of accuracy that clocks must attain before they are released from this department depends, to a certain extent, upon their grade. The highest grade clocks must not vary more than 5 seconds per day.

Tower Clocks are Built to Individual Specifications

Mechanisms used for the operation of clocks installed in towers are built in a separate building which operates on a jobbing machine shop basis, since tower clocks must generally be constructed to meet individual needs. This shop is equipped with such standardized machine tools as planers, shapers, milling machines, and lathes, because the parts for tower clocks are comparatively large in size.

The Seth Thomas Clock Co. has built many famous tower clocks, including the largest in the world, which is mounted on a building of the Colgate Co., Jersey City, N. J. On this clock, the tip of the minute hand travels around a circle 50 feet in diameter. It moves a distance of 31 inches every minute. The minute hand measures 27 feet 3 inches long, exclusive of the counterbalance, which adds another 10 feet. The total weight of the hand, including the counterbalance, is 2200 pounds. The hour hand is 19 feet 5 inches long and, with the counterbalance, has an over-all length of 27 feet 6 inches. It weighs 1725 pounds, including the counterbalance. The entire weight of the movement and hands is about 4 tons. The hand shafts revolve in large double-row ball bearings. One of these bearings is 15 3/4 inches in diameter and is furnished with 2-inch balls.

Other well-known Seth Thomas tower clocks are the first Colgate clock, now on the Colgate factory at Jeffersonville, Ind.; the four-dial clock on the new Paramount Building, New York City; and the clocks on the Philadelphia Inquirer Bldg., City Hall, and Independence Hall, Philadelphia, Pa.; McCormick and Straus Bldgs., Chicago, Ill.; Elgin National Watch Co., Elgin, Ill.; Hamilton Watch Co., Lancaster, Pa.; Nassau Hall, Princeton, N. J., and Battel Chapel, Yale University, New Haven, Conn.

* * *

The American Society for Steel Treating, 4600 Prospect Ave., Cleveland, Ohio, announces that a new local chapter of the society has been formed at Columbus, Ohio, through the organizing efforts of J. O. Lord of the Ohio State University.

A. S. M. E. MACHINE SHOP PRACTICE MEETING

The Machine Shop Practice Division of the American Society of Mechanical Engineers announces that it will hold its first national meeting during the seventh annual machine tool exhibition, to be held at New Haven, Conn., September 6 to 9. Meeting sessions are planned for the mornings of September 7, 8, and 9. The show itself will be closed during the meetings so as not to detract from the attendance at the technical sessions. One of the meetings will be devoted to the selection of machine tool equipment, at which time Myron Curtis, chief engineer, Potter & Johnston Machine Co., Pawtucket, R. I., will present a paper on "Economics of Machine Tool Replacement," and L. C. Morrow, managing editor of the *American Machinist*, will speak on "Advantages of Up-to-date Machine Equipment."

One session will be devoted to the problems of finishing mechanical equipment. The principal speakers at this session will be W. R. Atwood of the Chemical Products Division of E. I. DuPont de Nemours & Co., Parlin, N. J., whose subject will be "Modern Finishes for the Machine Tool Industry," and B. H. Divine, president, Divine Brothers Co., Utica, N. Y., who will speak on "Fundamentals of Polishing."

A session on foremanship training will be under the direction of John T. Faig, president of the Ohio Mechanics Institute, Cincinnati, Ohio. Another session will be devoted to the cold working of metals. John R. Shea, assistant superintendent, and John L. Alden, contract engineer, of the Western Electric Co. will present a paper entitled "Improvements in Copper Wire Mill Equipment," and James H. Connolly, general manager, and Thomas Allen, engineer, of the Standard Machinery Co., Auburn, R. I., will speak on "Rotary Swaging and its Effect on Materials."

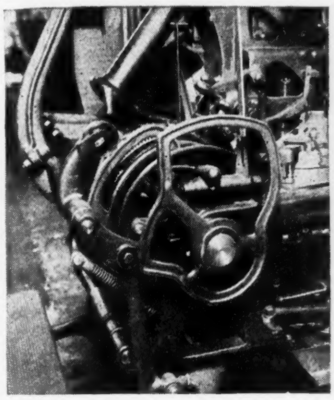
Still another session will be devoted to anti-friction bearings. Robert F. Runge, vice-president, S K F Industries, Inc., New York will speak on "Principles of Designing Machine Tools with Anti-friction Bearings," and Frank Brauer, chief draftsman, Watertown Arsenal, Watertown, Mass., will deal with "Anti-friction Bearings in Ordnance Work."

* * *

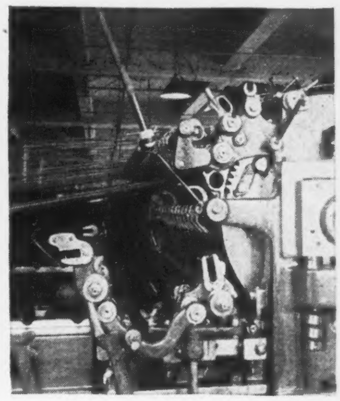
MEETING OF SOCIETY FOR TESTING MATERIALS

The thirtieth annual meeting of the American Society for Testing Materials will be held at French Lick Springs Hotel, French Lick, Ind., June 20 to 24. A very complete program has been planned, including, in the metal-working field, sessions on wrought iron, cast iron, magnetic testing, corrosion, endurance testing, wear testing, non-ferrous metals, metallography, and preservative coatings. Among the addresses to be given at the meeting is one by Dr. George L. Clark on "X-rays in Industry." Further information may be obtained from the secretary of the association, 1315 Spruce St., Philadelphia, Pa.

It has also been announced that the International Congress for Testing Materials will be held September 12 to 17 at Amsterdam, Holland.



Ingenious Mechanical Movements



SELF-CONTAINED AUTOMATIC DIAL FEED

By VICTOR ARKIN

An automatic dial feed mechanism of original design has been selected by the writer for consideration in MACHINERY'S Prize Contest on Ingenious Mechanisms because it is not only ingenious mechanically, but also useful to many manufacturers. In this design, the necessary indexing and locking movements are obtained by very simple means through a self-contained mechanism which can be mounted on a press or removed from it quickly, without drilling holes in the press or attaching connecting-rods, levers, or other operating parts, to the crankshaft. A simple chain connection with the punch-holder provides the motions required for unlocking the dial and indexing it to the next station or working position.

The upper end of this chain *A* (see Fig. 1, which is partly diagrammatic) is attached to extension *B* on the punch-holder, and the lower end connects with indexing lever *C*. As the end view shows, the chain passes around a guide pulley *D*. The swinging movements of lever *C* about its pivot *E* are utilized in conjunction with spring controls, as described later, to unlock, index, and again lock dial *F*.

Pawl *G* is used for indexing dial *F*, and pawl *H* for locking the dial so that each successive die is accurately located relative to its punch and the dial is held securely during the working stroke. How the indexing and locking movements are derived will now be explained by describing the action of the different parts during, first, a downward and then an upward stroke of the ram.

Fig. 1 shows the dial in its normal or locked position. As the ram moves downward, the horizontal part of the chain moves in the direction in-

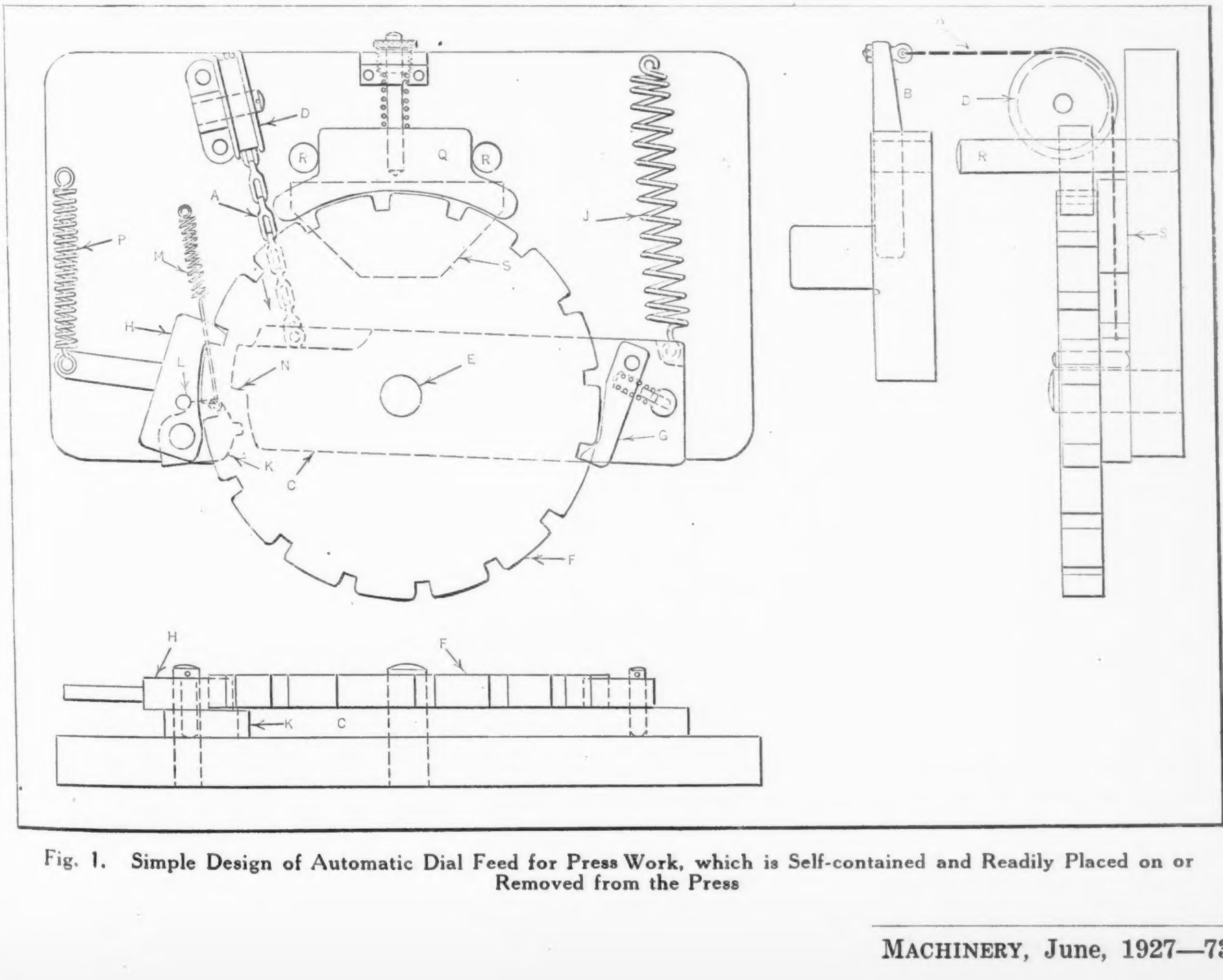


Fig. 1. Simple Design of Automatic Dial Feed for Press Work, which is Self-contained and Readily Placed on or Removed from the Press

dicated by the arrow (see also upper view, Fig. 2) and spring *J* turns lever *C* around its pivot *E*. The locking-pawl release-lever *K* is normally held against stop-pin *L* in locking pawl *H*, by a light spring *M*, as shown in Fig. 1, but when the projection *N* on lever *C* engages lever *K*, as shown by the upper view Fig. 2, lever *K* turns about its pin, allowing *C* to pass. Pawl *H*, however, is not disturbed, the dial remaining locked.

This turning movement of lever *C* also with-

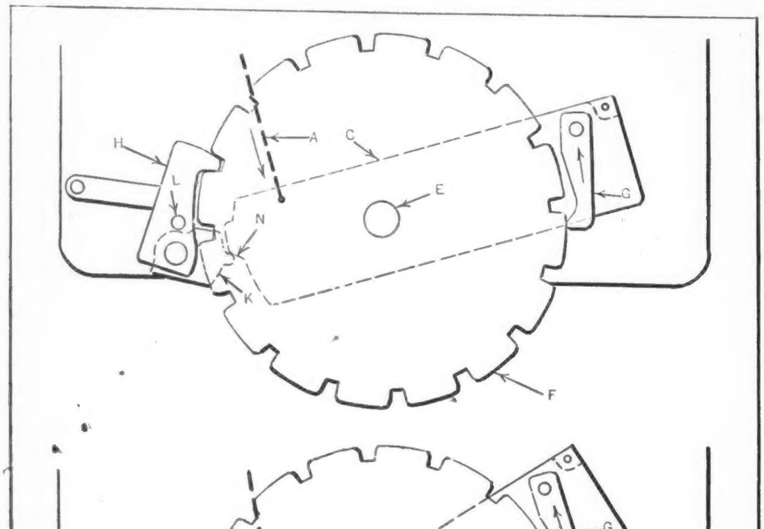


Fig. 2. Three Views showing the Action of the Locking and Indexing Mechanism of the Automatic Dial Feed

draws indexing pawl *G* preparatory to the next indexing movement. The central view in Fig. 2 shows the relative positions of the parts when the ram is near the bottom of its stroke. The projection *N* has passed lever *K*, thus allowing lever *K* to swing back to its position against stop-pin *L*. Meanwhile, ratchet *G* has withdrawn nearly a space and a half around dial *F*.

As the upward stroke of the ram begins, the movements are, of course, reversed, as indicated by the arrows in the lower view, Fig. 2. The chain connecting with the punch is now pulling lever *C* in the opposite direction. While pawl *G* is moving from the position shown in the central view around into engagement with slot *O*, the dial is unlocked by the engagement of lever *C* with *K*, which, in turn, acting against pin *L*, swings pawl *H* back to the position shown by the lower view. The continued movement of lever *C*, acting through pawl *G*, indexes the dial, and just before the ram reaches the top of its stroke, lever *K* clears projection *N*, thereby allowing the larger and more powerful spring *P*, Fig. 1, to swing pawl *H* into the locking position against the tension of the lighter spring *M*. This completes the cycle of movements.

It will be noted that the important motions required for unlocking and indexing are derived from the positive action or pull of the chain. This dial feed is used on a press that runs at 90 revolutions per minute. It is advisable to have a hard wood brake *Q* (see Fig. 1) to assist pawl *H* in preventing the dial from over-running at the end of the indexing movement. Two guide pins *R* assist in aligning the punch and in keeping all parts together when the attachment is removed from the press. A hardened steel plate *S* takes the thrust of the punching, forming, or drawing operation. Spring *P* is 1/2 inch in diameter, 4 inches long, and made of 0.060-inch steel wire; spring *M* is 5/16 inch in diameter, 2 1/2 inches long, and made of 0.035-inch wire; and spring *J* for the indexing lever is 1 inch in diameter, 4 inches long, and made of 0.080-inch wire.

The particular dial feed illustrated was designed by the writer for use on a standard press having a 2-inch stroke, and it is used in assembling small locks requiring a number of operations, such as bending lugs, upsetting pins, etc., the work being indexed successively under the different punches (not shown) attached to the punch-holder. Locating gages or pockets are attached to plate *F* and the completed parts are ejected in front by air pressure. Plate *F* also serves as a bolster plate in order to provide ample die space.

The ease and rapidity with which this dial feed can be placed in position or removed from the press is an important feature of the design, as it can be applied or removed as quickly as an ordinary die having leader or guide pins. Owing to the simplicity of the design of this mechanism, it costs little to construct, so that it is practicable to have a number made for different operations or parts, the self-contained feeding mechanisms being interchange on the press, the same as dies.

* * *

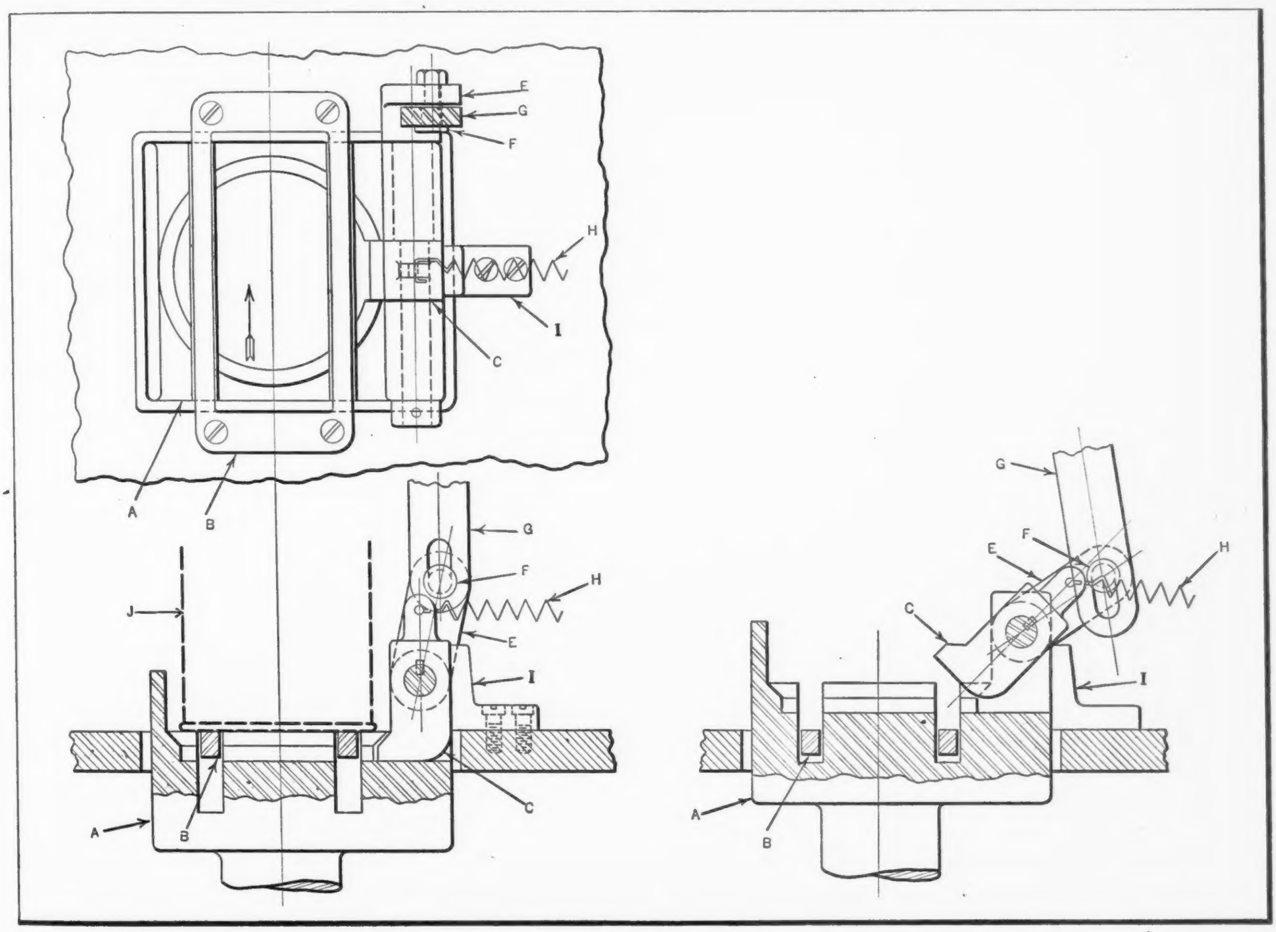
STOP MECHANISM THAT OPERATES WHEN WORK IS NOT IN POSITION

By EARL R. PHINNEY

A machine for placing covers on cans required a device to prevent a cover from being dropped when there was no can in place to receive it. The

cans are pushed one at a time in the direction of the arrow (see plan view of the diagram), and they slide along bridge *B* and stop over table *A*. This table is slotted to allow it to move upward until the recessed surface is raised above the surface of the bridge. As the table rises, the can is centered by a chamfered edge, and raised to receive a cover. The cover dropping mechanism is operated by link *G* which, in turn, is operated by stud *F* on arm *E*.

This device is most easily explained by first considering its action when table *A* rises without a can in place. Referring to the sectional view at the left, a detector foot is shown at *C*. Spring *H* is attached to the upper end of the detector foot and tends to swing it to the right, but this turning is prevented by block *I*. The detector foot is keyed to a shaft which



A Machine which Places Covers on Cans is Equipped with this Mechanism which Stops Action of Cover-dropping Mechanism if Can is not in Position

is carried by the table, and when the center of the shaft passes the top of the block *I*, the foot is pulled over by the spring, as shown in the right-hand view. This also allows arm *E* to swing over without causing an upward movement of the link *G*. It will be noticed that this link is slotted so that stud *F* cannot move it until after the detector foot has reached a point where it can swing. Thus it is seen that if there is no can on the table, the detector foot, arm, and link will swing without actuating the cover-dropping mechanism.

Now suppose that a can *J* is in place on the bridge. As the table rises, the can settles into the recess, and when the shaft center passes the top of block *I*, the toe of the detector foot will come into contact with the rim of the can. The can prevents any further swinging movement of the foot, and therefore stud *F* pushes link *G* upward, thereby causing a cover to drop. The center of the stud in arm *E* is placed slightly to the right of the center of the shaft; so that while there is some tendency to swing the foot, it is not enough to crush the can.

* * *

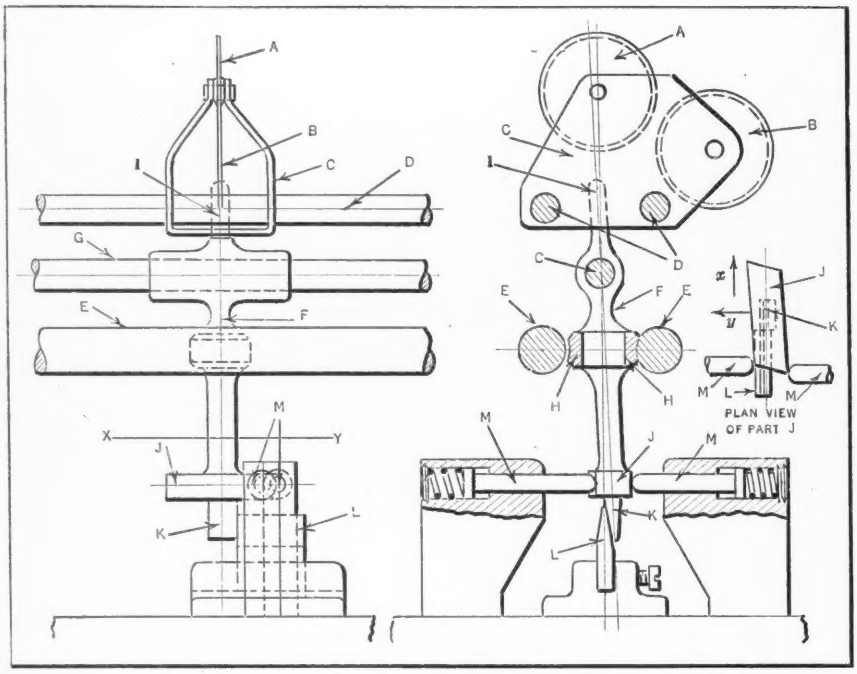
QUICK-REVERSING MECHANISM FOR WIRE COILING

By PHILIP GATES

The rapid reversing mechanism to be described is embodied in a machine for winding coils having a number of layers one upon the other, as used in the electrical trade. As the device that guides the wire on the coil arrives opposite one end of the coil, instantaneous reversal of direction is necessary in order to avoid the turns of wire piling upon one another. The results obtained with this reversing mechanism are highly successful.

The wire is fed from the supply drum over pulley *A* (see illustration) and under pulley *B* and then on the coil spool. As the latter is not driven in a special manner, it is not shown. The two pulleys are kept very thin, so as to get close up to the flanges of the spool. These V-pulleys are mounted in the carriage *C*, which is capable of sliding along the guide rods *D*. Beneath these rods are located two lead-screws *E* of a pitch equal to that of the wire when wound on the spool. These are rotated in opposite directions.

Suspended between the lead-screws is the lever *F*, which slides along the guide rod *G*. Embodied in this lever are two half-nuts *H* which, as the



Special Lathe Equipment Developed for Grinding Worm Threads
Prevents Turns of Wire from Piling upon One Another at the Coil Ends

lever swings from one side to the other, engage alternately with the lead-screws *E*. Thus the lever will travel to the right or left according to which screw it is in mesh with.

The top of the lever carries an extension *I* which engages in a slot in the base of the carriage *C*, thus giving it the necessary motion. It will be obvious that the peg *I* must be free to swing as the lever is moved, but must have no side play. Lower down on the lever is fixed a hardened steel rhombus-shaped part *J*. This is located at an angle, as seen more clearly in the plan view. Beneath this is a hardened steel wedge *K* which is kept in contact with another inverted wedge *L* by means of the spring plungers *M*.

It will be seen, then, that when one half-nut is in contact with a lead-screw the steel wedges either slide or are ready to slide against each other. The method of securing the reversal will be more easily seen by examining the plan view of part *J*. Here part *J*, fixed to the lever, has moved along in the direction of arrow *x*. By so doing and due to its angular location, it has compressed the right-hand plunger. At the same time it has reached the end of its traverse and the two wedges *K* and *L* are about to separate.

Thus, at this moment, part *J* will be forced by the plunger, in the direction of arrow *y*, and the half-nut will mesh with the opposite lead-screw. The lever *F* will then immediately reverse its direction, and the cycle indicated will be repeated.

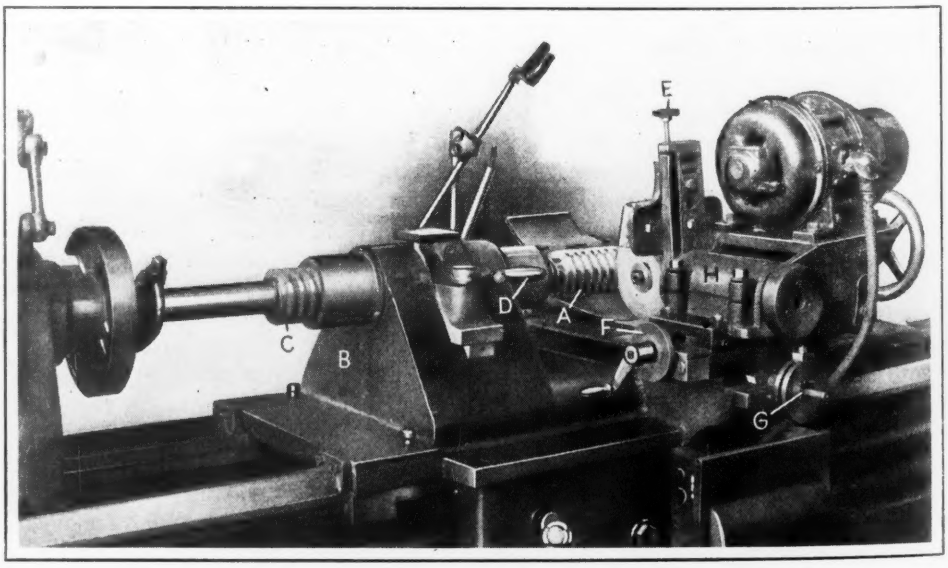
For winding coils of varying length, it is merely necessary to increase or decrease the length of the lower wedge *L*. As this device is automatic, except for the placing and removing of bobbins, and the starting of the wire, one operator can take charge of several machines.

* * *

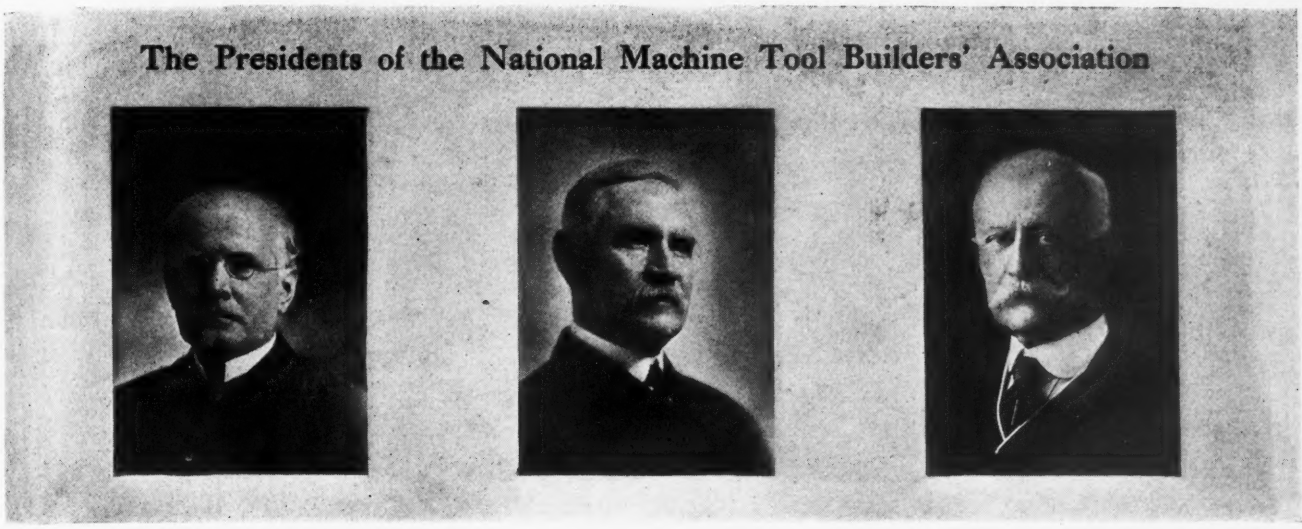
GRINDING WORMS IN A LATHE

Form-grinding of worm threads is accomplished at the Gleason Works, Rochester, N. Y., with the equipment shown in the accompanying illustration. This equipment consists of a standard lathe provided with a special carriage and an individually driven grinding head. The worm to be ground is mounted on an arbor, as shown at *A*, the arbor extending from the headstock and through housing *B* of the carriage to the tailstock. Centers support the arbor at both ends, and it is driven by a dog connected to the faceplate of the headstock. On the arbor is a master thread *C* which corresponds with the thread of the worm to be ground. In an operation, a half-nut within housing *B*, which is operated by means of lever *D*, is engaged with the master thread to draw the housing longitudinally along the bed. Since the housing is integral with the carriage on which the grinding head is mounted, the grinding wheel is traversed with the housing at a feed identical to the lead of the work.

The grinding wheel is form-dressed by means of diamonds fed on the wheel by the fine adjusting screw *E*. Before a grinding operation is started, the wheel is accurately positioned relative to the threads of the work by means of longitudinal and transverse micrometer screws located at *F* and *G*, respectively. To permit tilting the grinding wheel to suit the helix angle of the thread being ground, the entire grinding wheel unit may be swiveled about a trunnion that extends through housing *H*. A separate master thread is, of course, necessary for each worm of different lead.



Special Lathe Equipment Developed for Grinding Worm Threads



Joseph Flather
President, 1902-1903

William Lodge
President, 1903-1905

E. M. Woodward
President, 1905-1907

Twenty-fifth Anniversary of the National Machine Tool Builders' Association

By AUGUST H. TUECHTER, President, Cincinnati Bickford Tool Co., Cincinnati, Ohio

THE National Machine Tool Builders' Association grew out of a little meeting, held in New York in the spring of 1902, of seventeen lathe builders, who were called together at the invitation of William Lodge, president of the Lodge & Shipley Machine Tool Co., of Cincinnati, to talk over their mutual problems in a friendly way. There were reasons a-plenty for earnest consideration of the situation that confronted these seventeen builders, and in fact, the whole machine tool industry, at that time.

The competition of twenty-five years ago was a bitter rivalry. Business judgments were founded on hearsay and rumor—mostly a jumble of misinformation. The shrewd buyer who was willing to employ such methods found that it served his purpose to sow seeds of distrust and enmity among competing sellers. Definite standards of business practice among the members of any given industry were rare. In the face of the "business-at-any-cost" policies of the majority, it was a difficult matter for the smaller, weaker companies to formulate sound policies or adhere to good business practices. For the machine tool industry, whose problems were so different, so little understood, and so much more difficult than those of industries not so far removed from the consumer, it was hard even to determine what was good policy and what was not.

Part Played by Mr. Lodge in the Formation of a National Association

Mr. Lodge had given these matters especial thought. Early in the history of his own business, he had discerned greater opportunities in specialized production, and by 1900 had become one of the leaders in the manufacture of lathes. Here, again, the peculiar problems of the machine tool industry became intensified when the field was narrowed down to but one of its products. The rapid expansion of all industrial enterprise through the nineties had been reflected in the growth of the number of machine tool shops. Particularly throughout the Middle West many new shops had sprung up, all eager to take what business could be had on any terms, regardless of the effect on their own business or on the industry as a whole. The future did not look inviting. A demoralized industry cannot go forward, and demoralization appeared to be lying in wait just around the corner.

Mr. Lodge and others of the lathe group were convinced that fear and distrust arising out of ignorance of competitors' policies were strongly contributing elements in the threatened demoralization; that the substitution of a friendly spirit of cooperation was the first step necessary in combating the unsound practices and evils that were promising to choke off their industry's progress; so a meeting was called. The seventeen manufacturers who responded unanimously endorsed the association idea, and out of that meeting grew the National Machine Tool Builders' Association, the object of which, as stated in the Constitution and By-laws adopted in 1902, is "To promote the interests of the National Machine Tool Builders in the direction of good fellowship, and the liberal discussion of subjects pertaining to the sale of machine tools."

First Officers of the Association

The first officers elected were as follows: President, Joseph Flather, Flather & Co., Inc.. Nashua, N. H.; first vice-president, William Lodge, The Lodge & Shipley Machine Tool Co., Cincinnati, Ohio; second vice-president, W. P. Davis, W. P. Davis Machine Tool Co., Rochester, N. Y.; secretary, P. E. Montanus, Springfield Machine Tool Co., Springfield, Ohio; treasurer, Enoch Earle, P. Blaisdell & Co., Worcester, Mass.

The Presidents of the National Machine Tool Builders' Association

F. L. Eberhardt
President, 1907-1909

F. A. Geier
President, 1909-1911

E. P. Bullard, Jr.
President, 1911-1913

W. A. Viall
President, 1913-1915

Good fellowship was the central thought of the plan—good fellowship and a friendly interchange of ideas. Out of this it was hoped would emerge a universal adoption of those policies or practices found to be good and beneficial to the whole industry.

The First Seventeen Members of the Association

It might be interesting here to review the names of the firms who were represented at that early meeting:

American Tool Works Co., Cincinnati, Ohio
P. Blaisdell & Co., Worcester, Mass.
Bradford Machine Tool Co., Cincinnati, Ohio
W. P. Davis Machine Co., Rochester, N. Y.
Draper Machine Tool Co., Worcester, Mass.
Fairbanks Machine Tool Co., Springfield, Ohio
Flather & Co., Inc., Nashua, N. H.
Greaves-Klusman & Co., Cincinnati, Ohio
Hamilton Machine Tool Co., Hamilton, Ohio
Hendey Machine Co., Torrington, Conn.
R. K. LeBlond Machine Tool Co., Cincinnati, Ohio
Lodge & Shipley Machine Tool Co., Cincinnati, Ohio
Prentice Bros., Worcester Mass.
Rahn, Mayer & Carpenter Co., Cincinnati, Ohio
F. E. Reed Co., Worcester, Mass.
Schumacher & Boye, Cincinnati, Ohio
Springfield Machine Tool Co., Springfield, Ohio

The First Annual Meeting in 1902

In October, 1902, the first annual meeting of the association was held in Cleveland, Ohio, the membership having grown to thirty-three companies representing builders of lathes, milling machines, drilling machines, shapers, and grinding machines. Every one of the thirty-three member companies was represented at the meeting.

Although the main object of the association was the promotion of good fellowship, it is an interesting fact that immediately following its organization, the attention of all members was directed toward the earnest consideration of some specific problem—sometimes one that affected only the machine tool builders, but more often a question of general interest affecting all industries.

The first paper presented before the association at its first annual meeting in 1902, by F. A. Halsey, dealt with the metric system, and a resolution was adopted by the association opposing the system because of the enormous first cost of new equipment required to conform to the new standards, the cost of maintaining a double standard for repairs and renewals, and the consequent increased cost of the product to the consumer. Copies of the resolution were sent to the chairman of the House Committee of Congress, the National Metal Trades Association, and the National Association of Manufacturers.

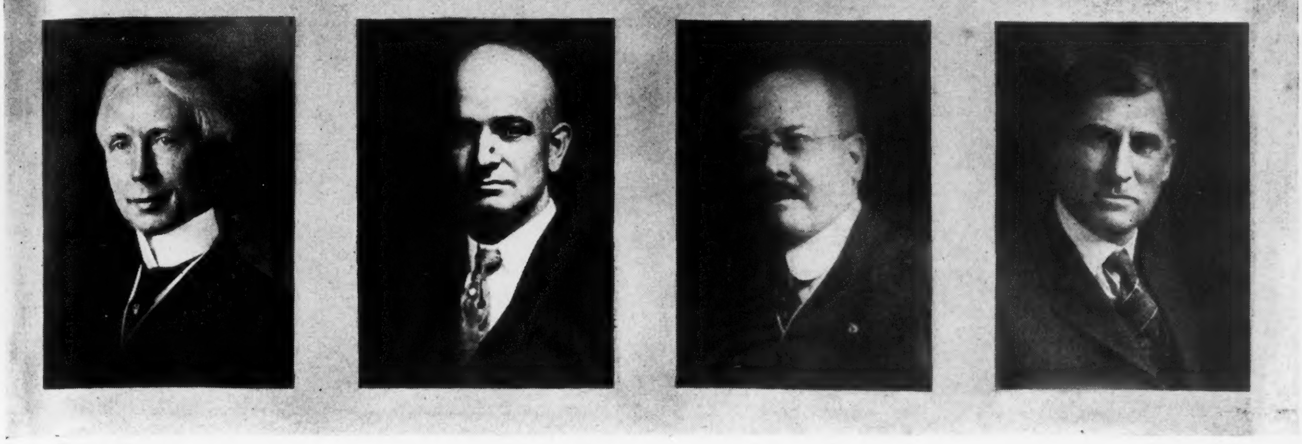
This is the first record of a united effort on the part of the machine tool builders, acting together as an industry, on a question of interest to all manufacturers in the country. It represented the awakening of an industry consciousness—a realization of a new power that from that time on was to make its own place in the nation's business. A review of later discussions shows that at some time or other practically every problem that confronts industry today has come in for its share of thought and attention.

Standardization of parts, that we look upon as a question of our own time, was earnestly advocated by Mr. Lodge, of the Lodge & Shipley Machine Tool Co., in a paper before the association at the annual meeting in 1903, when the new association was but a year old. It was about the time of the introduction of high-speed steel, when an unprecedented revolution in design was imminent. Commenting on the radical changes that were being foreshadowed, Mr. Lodge advocated the adoption of standard parts that would facilitate "interchangeability of faceplates, chucks, and tools."

Concerted Action Relating to Foreign Trade Problems

In 1906, when the United States Government appropriated a large sum of money for an investigation of possibilities of foreign commerce, the association secured recognition for the machine tool industry as an important factor in our export trade. European markets for machine tools were then absorbing approximately 30 per cent of our total out-

The Presidents of the National Machine Tool Builders' Association



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J. B. Doan
President, 1915-1918

A. E. Newton
President, 1918-1920

August H. Tuechter
President, 1920-1922

Edward J. Kearney
President, 1922-1923

put, and were giving promise of even greater development. Captain Godfrey L. Carden, of the United States Revenue Cutter Service, who was appointed by the Department of Commerce and Labor to represent the industry, spent two years in Europe. His reports, published from time to time in the *Daily Consular and Trade Reports* of the Department of Commerce and Labor, were most encouraging, testifying to the superlative merit in design and workmanship of American tools, and pointing out marketing policies to be followed to strengthen our position. These reports were of inestimable value to the individual firms who were striving to build permanent markets in European countries.

Study of Apprenticeships—Tariff Legislation

In 1907 a study was made of machinist apprenticeship contracts. Sample terms and contracts were drawn up for the guidance of members, and arrangements made for an engraved diploma bearing the seal of the association, to be given to the apprentice on the successful completion of his term. The plan outlined is still successfully followed at the present time.

In 1908, when revision of the tariff was a question of national concern, machine tool builders, through the association, secured a separate classification for the industry under the heading "machine tools," volunteering at the same time a reduction in the tariff on machine tools. The reduction held until after the World War, when the Tariff Committee restored the percentage as a protection against a possible flood of foreign-made tools brought in at depreciated currency prices, and the consequent weakening of an industry indispensable to the national defense.

The Machine Tool Industry in the World War

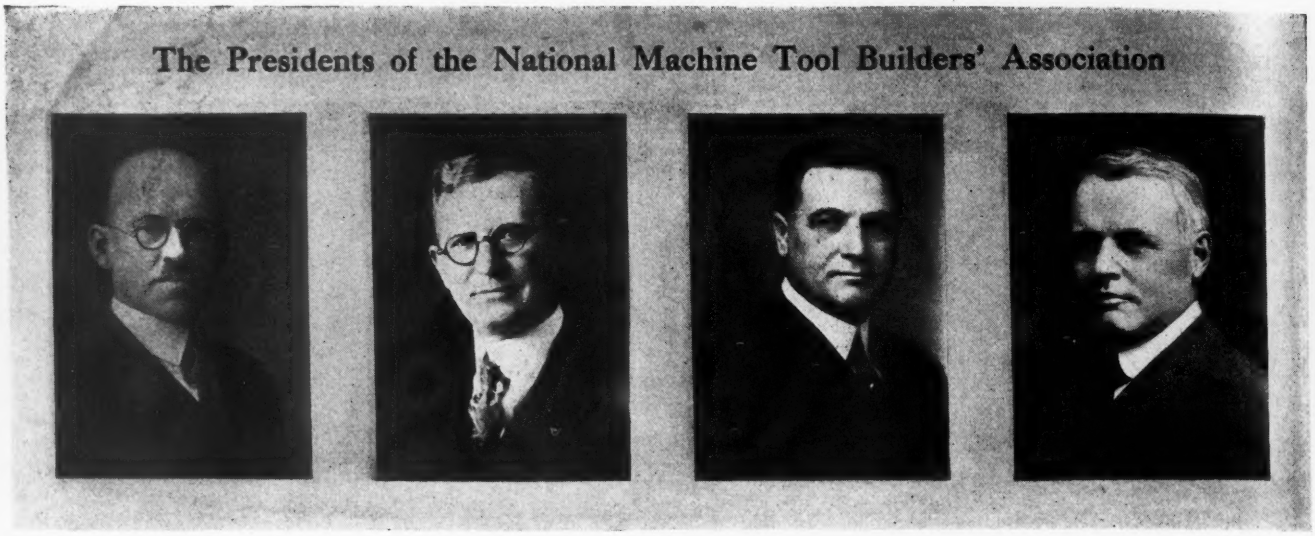
The part the industry played in speeding up the machine capacity during the World War is too familiar to all to bear repeating here. It is enough to say that once more the association justified its existence by cooperating with government departments, and keeping members of the industry informed of new developments. The trials of the Ordnance Department in the last war in mobilizing industry are a matter of record, and the part that trade associations played in bringing about coordinated action has won for them all well deserved commendation.

Growth and Progress of the Association

The demands made upon the association during the war and post-war periods emphasized the need for a central association office, with a full-time general manager and assistants. In 1920 the executive committee recommended that steps be taken to raise the association to the dignity of a business organization, making of it a bureau of information for the use of the members and all others associated with the industry. The executive committee especially recommended that a study be made of the industry's economic position, as a foundation for a campaign of education with the aim in view of putting the business of the industry on a sounder, safer basis.

These recommendations were enthusiastically endorsed by the members, and Ernest F. DuBrul, present general manager, was chosen to conduct the work. By January, 1921, he had established an office at Cincinnati, had organized a working force, and at a special meeting of the association called in February, 1921, was able to present a brief survey of the industry's position relative to other basic industries, and to show the trend of the industry's orders, which at that time was sharply downward.

Gloomy though the outlook was just before the depression of the summer of 1921 had reached bottom, Mr. DuBrul's work received the hearty endorsement of the members, and he was authorized to continue his studies. This work, which is being carried forward now as only one part of our association activities, is resulting in a growing appreciation of the isolated position of the industry in respect to the nature of its problems—its long periods of depression when business is bad, and its short, sharp peaks of activity, when all other business is prosperous; its difficult marketing problems; its tedious management problems; and its financial hazards.



Ralph E. Flanders, President, 1923-1924 — O. B. Iles, President, 1924-1925 — H. M. Lucas, President, 1925-1926 — James E. Gleason, President, 1926-1927

The present organization of the association makes it possible to conduct many activities that were not formerly practicable. There is a bulletin service which keeps members posted on questions relating to administrative, technical, and sales matters. The association is sponsoring certain standardization projects through the American Engineering Standards Committee. Users of machine tools are being educated through an advertising campaign, advising them to keep closer tab on the results obtained from their machine tool equipment. A code of ethics has been adopted with a view to eliminating such practices as are destructive of principles of good business conduct in the industry. The association is cooperating closely with the United States Department of Commerce through the Industrial Machinery Division.

Fine Leadership Has Been the Good Fortune of the Association

The association may well be proud of what has been accomplished in the twenty-five years of its existence and may gratefully attribute its achievements to the quality of the leadership that it has had the good fortune to enlist during this period. Throughout its history, the best and most capable of the industry's executives have given their time and effort to the interests of the association and have served on its board of directors. Fifteen of these executives have served as presidents, the names and the terms of office of the association's chief executives being:

1902-1903, Joseph Flather, Flather & Co., Inc., Nashua, N. H.

1903-1905, William Lodge, Lodge & Shipley Machine Tool Co., Cincinnati, Ohio.

1905-1907, E. M. Woodward, Woodward & Powell Planer Co., Worcester, Mass.

1907-1909, F. L. Eberhardt, Gould & Eberhardt, Newark, N. J.

1909-1911, F. A. Geier, Cincinnati Milling Machine Co., Cincinnati, Ohio.

1911-1913, E. P. Bullard, Jr., Bullard Machine Tool Co., Bridgeport, Conn.

1913-1915, W. A. Viall, Brown & Sharpe Mfg. Co., Providence, R. I.

1915-1918, J. B. Doan, American Tool Works Co., Cincinnati, Ohio.

1918-1920, A. E. Newton, Reed-Prentice Co., Worcester, Mass.

1920-1922, August H. Tuechter, Cincinnati Bickford Tool Co., Cincinnati, Ohio.

1922-1923, Edward J. Kearney, Kearney & Trecker Corporation, Milwaukee, Wis.

1923-1924, Ralph E. Flanders, Jones & Lamson Machine Co., Springfield, Vt.

1924-1925, O. B. Iles, International Machine Tool Co., Indianapolis, Ind.

1925-1926, H. M. Lucas, Lucas Machine Tool Co., Cleveland, Ohio.

1926-1927, James E. Gleason, Gleason Works, Rochester, N. Y.

Of these men, Joseph Flather died in 1907; William Lodge in 1917; and E. M. Woodward in 1923. The others are still active in business and contributing largely to the success of the association.

* * *

FILING AMENDMENTS TO PATENTS

In a statement prepared by G. Willard Rich, patent and trademark counsellor, 2 W. 46th St., New York City, relating to the changes made in the patent laws by the last session of Congress, it is mentioned that one of the most important advances made by the new law is the requirement that amendments must be filed by the inventor within six months following an action by an examiner. For a number of years past, the inventor could allow his case to lie dormant for a year at a time. The cutting of this period in half will result in a great benefit to industry in that the manufacturers, in the future, will be informed of the trend of inventions in their respective lines with reasonable promptness, and in attempting to meet a public demand will not be forced to go blindly ahead, only to find, after thousands of dollars have been invested, that some unknown and hitherto secret and long pending application has matured into a menacing patent. The American Bar Association lent its influence in a very helpful way to the achievement of the simplified patent practice embodied in the new law.

The British Metal-working Industries

From Machinery's Special Correspondent

London, May 19, 1927

THE industrial situation throughout the country, although not essentially changed, continues to show a little progress. Most firms are working steadily, and employment is generally increasing. Much appreciation is felt everywhere of the fact that the recent Budget has placed no new burdens on industry.

All branches of the metal-working industries are making steady progress, and all seem confident that better times are ahead. The fact that unemployment is still decreasing is another encouraging sign, the figures having fallen regularly each month this year, from 1,480,000 on January 1 to 1,000,000 on May 1—a decrease of about 30 per cent.

Machine Tool Industry Reports a Good Volume of Orders

Business in the machine tool industry is generally characterized as somewhat patchy, but on the whole, a good volume of orders is being maintained, and throughout the Midlands, at least, works appear to be well employed. At the majority of plants it is the practice to work to a stock program, and it is a sufficient index of the current situation to say that there are no substantial accumulations, the machines in each lot invariably being disposed of by the time they are completed.

Exports and Imports of Machine Tools Increase

The exported tonnage of machine tools rose well during March, the last month for which figures are available, reaching 1320 tons. This compares well with 1306 tons in January and 841 tons in February. The ton value dropped slightly to £111, compared with £113 in January.

The imported tonnage of machine tools also rose from 385 tons in February to 460 tons in March, with a slight increase in ton value from £180 to £182. The respective values of exports and imports of machine tools in March were £146,717 and £83,903, so that there is still a favorable balance on the export side. The comparison generally shows that March has had the effect of improving the tendency of the current year, as far as it is now revealed, but the export figures are still very irregular. The value of tools and cutters exported during March was £51,259, an increase of about £3000 over the figures of last month.

In comparing the full quarter with the previous few years, the effect on exports and imports must be considered separately. The exports are one point above 1926, three points below 1925, and five points below the 1921-1924 average, when deadweight is taken as an index of work done, and this is still, perhaps, the best index. The ton value of exports is rising slowly. The lowest level in 1925 was £109; in 1926, £112, and in the current year £115.

The export machine tool trade is expanding steadily in British India and unsteadily in Australia. It is also expanding in countries other than those mentioned. The present distribution, in percentages of value, is, roughly, as follows: European countries, 17; South Africa, 4; British India, 29; Australia, 13; other countries, 37.

The Shipbuilding Industry Shows Activity

The shipbuilding industry is still a bright spot in the engineering field, and good news is being received from all districts. Conditions in the Belfast yards are very satisfactory, and at present there is considerable activity in all departments, although new orders are a little slow in coming along. One good order placed during the past month is by the White Star line for a 25,000-ton motor-ship to be built by Harland & Wolff. It is probable that a decision will be reached regarding the 60,000-ton liner for the same owners which was ordered during the first part of the year, and an early start is expected. Negotiations have been completed for a guarantee of approximately £1,500,000 for the building of five motor-ships by the same firm, for the Royal Mail-Nelson service. Considerable activity prevails on Clydeside, and there is enough work to keep the yards going for a long time. The engineering establishments are busy.

Iron and Steel Works are Well Employed

Iron and steel works are generally well employed. There are sufficient orders on hand to keep most mills fully employed practically to the end of the year, and the outlook in every respect appears quite encouraging. It is said that many large consumers have not placed their orders for the steel required to fulfill contracts, but they are expected to do so very soon. This should add further to the activity. Makers of heavy steel are reported to have as many orders on hand as they can undertake. They are being pressed by shipbuilders, in particular, for deliveries.

Railway, Automobile, and Electrical Industries are Doing Satisfactory Business

Railway engineers and car builders are not busy on the whole, and there seems little prospect of large orders for home railways in the near future. Pullman car and coach builders are, however, obtaining good business from European railways. Electrical engineers are all splendidly occupied and are receiving good orders at home and from abroad. A number of important contracts are noted each month, and there seems no sign of any slackening in new business. Automobile engineers are generally very busy, there being over 5000 British cars produced for the home market alone per week. Heavy commercial vehicle makers without exception report improving business, and the vehicle export trade is increasing rapidly.

Current Editorial Comment

in the Machine-building and Kindred Industries

NEW TOOLS IN OLD MACHINES

Manufacturers of small tools and accessories—taps, dies, milling cutters, reamers, drills, and grinding wheels—sometimes receive complaints from their customers that the tools supplied by them are not giving satisfaction. Frequently it is found that the tool or grinding wheel is used in an old machine with loose bearings, in a machine that needs adjustment, or in one that is too weak in design to deliver the power required by modern cutting tools. Many of these defects of old and obsolete machines are blamed on the tools or grinding wheels. A visit by a service man or demonstrator is often necessary before the customer is convinced that the fault is with the machine equipment of his factory and not with the tools supplied.

Time is wasted and profits lost in many shops by using modern tools in obsolete machines. Present-day tools and grinding wheels have no opportunity of giving their best service in machines of old design that have neither the power to drive the tools at their full capacity nor the rigidity to prevent chatter. Speeds and feeds are frequently reduced to prevent chatter, because it is believed that the tools and grinding wheels "won't stand any more." As a matter of fact, it is the machine that, due to the "slender lines" of earlier designs, is incapable of giving production.

Before condemning new tools, examine the machine in which they are mounted; see whether the bearings are tight and properly adjusted, whether spindles are in alignment, and whether the machine is strong enough to deliver the power necessary for the capacity of the tools. When the tools do not produce a good finished surface, find out whether it is the machine that vibrates under the load. To get good results from modern high-speed tools and highly developed grinding wheels, powerful modern machine tools are generally required.

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GEAR-CUTTING SERVICE

Specialization in manufacturing has created an entirely new industry in the last twenty-five years. Previously, most manufacturers cut the gears required in the machines built by them in their own shops. In recent years it has become more and more the practice to have gear specialists produce them. This is true especially in the automotive industries, and to an ever-increasing extent in the general machine-building field as well.

The gear manufacturer, being a specialist, is generally able to produce not only a better, but also a cheaper, product. Devoting all his thoughts and energies to the production of gears, he acquires a greater experience in this field than a manufacturer who has only one or at best a few machines in his shop engaged in gear-cutting. Also, a gear manufacturer can furnish gears more economically because his equipment is fully employed, whereas in many plants that have only occasional need for gears, the gear-cutting equipment stands idle a large part of the time.

It is also well-known that when there is only work enough to keep the machines busy a portion of the time, there is a tendency on the part of the operators to slow down, so that the work will last longer. Naturally the men do not want to "work themselves out of a job"; and this feeling increases the manufacturer's labor costs.

Often there are special conditions which make it desirable for the gear user to produce his own gears, but in almost every such instance it is worth while to check up the advantages or saving gained by making them in the user's own shop to see if they outweigh the economy and convenience of having them made by a gear manufacturer. Also, it is well to compare the quality of the two different makes. In most other lines of work, it is assumed that a specialist is able to give better service.

* * *

CHANGING TERMS IN GENERAL USE

An important part of all standardization work in the industries is to standardize the names and terms used to designate materials, tools and machine parts. Much confusion has been caused by the use of different terms which mean the same thing; and still more confusion, perhaps, by using the same term to signify different things. There is a tendency, however, in this work of standardizing names and terms to change commonly accepted terms, and it may not be out of place to sound a warning against unnecessary changes of this kind.

Many engineers have called attention to one change that to them seems to invite confusion. For more than fifty years the thread system originally developed by William Sellers has been known as the United States standard thread. In adopting national standards for screw threads, a change was made in this name and, while thread form and pitches remain the same, the thread is called the American standard instead of the United States standard. This change was made because all standards accepted under the procedure of the American Engineering Standards Committee are to be known as American standards, and in the interest of uniformity, this name has also been applied to screw threads. Many manufacturers and engineers, however, deem it unwise to change the designation of a thread system that has been so thoroughly established and that is known all over the world as the United States standard.

In some cases there may be good reasons for discarding old names and making use of entirely new terms; but generally, such changes should be made only after very careful consideration and, wherever possible, established names should be retained.

National Machine Tool Builders' Meeting

THE twenty-fifth anniversary convention of the National Machine Tool Builders' Association was held at Hotel Thayer, West Point, N. Y., May 10, 11, and 12. An unusually large number of members were present, and the discussions and papers presented at the meeting covered a great many subjects of importance to the machine tool industry.

The President's Address

The president of the association, James E. Gleason, president of the Gleason Works, in his opening address briefly reviewed some of the achievements of the association during the last twenty-five years. He referred to the work on a uniform cost accounting system, modern sales policies, and standardization. On the latter subject he said in part:

"Very early in our organization work we established a permanent committee on standardization. This committee, as early as 1910, had sufficient influence to obtain the cooperation of the Electric Motor Manufacturers' Association in working out a range of horsepowers suitable for motor drives on machine tools.

"As the years have passed, the committee has struggled hard to establish standards of construction for machine tools that would be of real advantage to our industry. Being practical men, they were not satisfied to set up 'paper' standards—standards which for one reason or another would not be put into practice. They have consistently labored to devise standards built on mutual concessions and adjustments, which would not only be put into practice immediately, but would also be recognized by the user as the last word in improved design. At last these efforts are bearing fruit. Very recently an agreement was reached regarding standards for milling machine spindles. I am sure that we will soon hear announcements of the adoption of like standards from groups of our members building other machine tools.

"This year we are making the greatest single cooperative effort in our history—our Machine Tool Exhibition. We have a great opportunity to demonstrate how vitally the prosperity of the country is served by developments in the machine tool industry. Word has already come from abroad that England, France, and Germany intend to send large delegations to this exhibition to see the latest in American machine tools. We have not heard directly from the other European countries, but undoubtedly they will be well represented.

Counteracting the Effects of Business Cycles

"Whatever may have been true during and immediately after the war, there can be no question that never before in our history has labor been so efficient as it is today, and we have the responsibility of retaining this efficiency by keeping our forces intact. We must contrive in some way to avoid such drastic reductions in personnel as we have suffered in the past.

"There used to be a great deal of talk about the rights of capital as opposed to the rights of labor. Now we hear more of the mutual responsibility of capital and labor; the responsibility of capital to provide good working conditions and fair rewards; the responsibility of labor to perform its daily tasks loyally and efficiently. But there is another responsibility which it seems to me is fully as important, the responsibility of management and what many of us call the 'organization' to counteract the tendency of business to run to high peaks and deep valleys, and to insure continuity of employment for the many men who are now doing their share in carrying the burden of production.

"We have firms on our roster who have survived the ups and downs of business for periods up to a hundred years; firms whose product has continually improved and kept them in the front rank of our industry. As we look back on what their leaders have achieved we realize they have set us a high standard, and everyone of us will have a man's job to live up to it. True their success was not great, measured in dollars, and neither can we hope for large fortunes to result from our work. We can be proud, however, of what they did to lighten the labors of production, and if we can do as much, we will enjoy a satisfaction far beyond anything mere money can measure."

In his report, Ernest F. DuBrul, general manager of the association, stated that there are now 121 members. He briefly reviewed the general activities of the association, the plans for the coming exposition in Cleveland, September 19 to 23, and the regional meetings of the association held during February and March in Cincinnati, Cleveland, and Hartford. Separate reports were also presented by the committees on the exposition, the national industrial museum, and standardization.

Training for Executive Leadership

In an address by W. A. Viall, vice-president of the Brown & Sharpe Mfg. Co., a course of training for young men who would be expected to fill position of chief executives was outlined. Mr. Viall said in part:

"First of all, it is to be taken for granted that the young man has had the proper home training, that he is amenable to home influences, and has a mentality sufficient to give serious thought to the question of a life work. It has been my theory for many years that every boy should have at least a high school education, and whether he goes to college or not should depend upon his work and the interest he has shown in high school.

"If the boy is willing to work in college for the training that college will give him, he should take a course that will give him a liberal training in mathematics, economics, science, literature, and language—in short, that will make a broad man. I am considering the man who is planning to enter business as the future leader of it, and not the man who is planning to be an engineer and who may

later work into the executive end. I have purposely avoided a suggestion of college shop work or of technical training. When a college education accomplishes its purpose, it has taught a man to think for himself, to concentrate on the matter in hand, and to act intelligently.

Outline of Shop Training Required

"Then, when the young man goes into the business, how should he be trained? I think that the training should have two main objects: First, to give him a knowledge of the business in its various branches; and second, to give him a knowledge of men. The chances are that the young man has been brought up in a class entirely different from those whom he has to meet in the shop and work with, but he must meet them at first hand so that he may learn their language and their ways of thinking. He should be treated like one of the regular employes during his term of training. A course of work should be laid out that will give him an opportunity to learn the uses of tools in the various branches of the work. I stated in the foregoing that I had left out the question of technical training in the case of the college student. My reason was that I think this training should be obtained under practical working conditions of the shop in which his life is to be spent.

"In my opinion, two years in actual shop practice would not be too long. Following this, he should have a term in the drafting-room, taking up work that would give him facility to read drawings readily. In connection with this he should have an opportunity to get an insight into the methods pursued in carrying through a piece of work. Also he should have occasion to get something of an idea of the accounting system, routing system, etc. so that he will be able to comprehend problems in this direction.

First Steps in Executive Responsibility

"After he has had a good line of work in these directions, it is an excellent plan to place him as a sub-foreman on some job that will require executive work. It will give him a taste of the actual shop conditions, and here he will have a chance to try out in a small way his possibilities as a leader.

"Such a course as I am outlining will not make him a machinist or an engineer, but will develop his talent in the directions of comprehending processes, evaluating the use of tools, and above all, will bring him into close touch with men, giving him an angle upon his work that can be obtained in no other way. I have seen young men who have been put through some such course as this take their place in the works, and when problems are brought to them later, it is extremely helpful and gratifying to find that they can discuss them from the point of view of a shop man who understands the details of what he is talking about.

"During these years of shop experience, it would be well to have the young man make a few well-planned trips to other manufacturers, and on the completion of his work, before taking the responsible position that may have been planned for him, a trip abroad would be a great help. He would there see other ways of manufacturing and get points of view that would broaden him and make him still more helpful in his position.

The Objects of the Training Outlined

"In outlining this training schedule, I have had in mind three specific ends:

"1. A working knowledge of the details of the business, both in its mechanical operation and in its executive lines.

"2. Discipline. I firmly believe that no man is equipped to take charge of help unless he himself has undergone a thorough training that involves discipline. If the young man is equipped to follow on as the leader of the business, he will have occasion to observe, during his shop training, the necessity of proper discipline, and his own obedience to it is a necessary preparation to carry on in his life work.

"3. A knowledge of men through personal contact. I reiterate this, because I attach much importance to it."

Safeguarding of Machine Tools

A paper entitled "The Proper Safeguarding of Machine Tools" was read by G. V. Fuller, assistant secretary of the National Council on Compensation Insurance, New York. Mr. Fuller presented some very interesting statistics showing the prevalence and seriousness of accidents in relation to different types of machines.

George Merryweather, of the firm of Motch & Merryweather, Cleveland, Ohio, spoke on the recent Leipzig Fair and the machine tools exhibited there.

Celebrating the Twenty-fifth Anniversary of the Association

On page 737 of this number will be found a historical review of the activities of the National Machine Tool Builders' Association during the last twenty-five years. The twenty-fifth anniversary of the association was celebrated on the evening of May 10, brief addresses being made by many of the members. J. Wallace Carrel, vice-president and general manager of the Lodge & Shipley Machine Tool Co., spoke at length on the personality and achievements of William Lodge, through whose initiative and efforts the association was formed. Later, the motion picture "The Age of Speed," described in May MACHINERY, was shown by the Norton Co.

In the afternoon of the last day of the meeting, the members of the association were invited to join with the metropolitan sections of several of the national engineering societies that were visiting West Point. A special program had been arranged by the military authorities, the various societies being the guests of Brigadier General M. B. Stewart, superintendent of the Military Academy, under whose direction a complete tour of the grounds and buildings was made.

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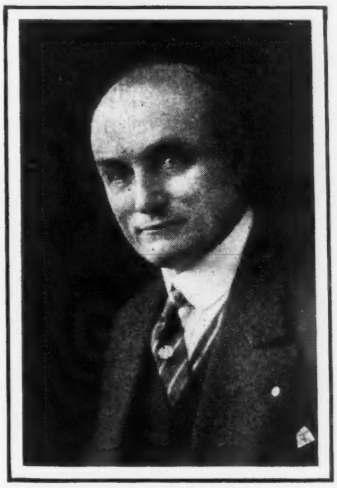
Awards amounting to $48,400 were paid to 4405 employes of the General Electric Co. during 1926 for suggestions that either improved working conditions or tended to increase the efficiency of the company's operations. During the year 13,703 suggestions were offered, an increase of 2500 over the previous year, and more than 32 per cent were accepted. The awards ranged up to $1000, averaging $11 per person.

Annual Meeting of Gear Manufacturers

THE eleventh annual meeting of the American Gear Manufacturers' Association was held at the Hayes Hotel, Jackson, Mich., May 12, 13, and 14. As usual the meeting was characterized by a very complete program, and earnest attention was given to the association's standardization work. In opening the meeting, the association's president, E. J. Frost, president of the Frost Gear & Forge Co., Jackson, Mich., spoke on "Standards and Specialization." He first referred to the progress of the standardization work undertaken by the association, and called attention to the difficulty sometimes encountered in agreeing upon proposed standards. He urged that all reports and standardization proposals be considered with the utmost broadmindedness and in a spirit of give and take, so that proposed standards may have a chance to be fairly tried out, and later altered if experience should so dictate.



E. J. Frost, President, American Gear Manufacturers' Association

Rapid Changes in Gear Industry and Their Effect

The rapid changes that have taken place in the gear industry in the last fifteen or twenty years were referred to by Mr. Frost. Chemistry, alloy steels, and the use of the microscope were practically unknown quantities in the gear industry a few years ago. Today, there is an insistent demand for better steels and other materials used in gears, new alloys are continually being developed, and new methods of hardening and heat-treating are discovered.

The industry has been compelled to establish chemical and physical laboratories and extremely sensitive pyrometer systems. Technically trained men have had to be employed and given shop experience to fit them for the tasks imposed on the industry. Electrically heated furnaces are taking the place of former types, and shop equipment has undergone marvelous improvements; and in the distance hovers the possibility of changes in types of product which may call for the installation of an entirely new set of machines, radically different in construction, and relegating to subordinate use, or perhaps to the scrap heap, otherwise useful equipment. "Considering the skill, experience, and financial risk involved, it may well be asked if this important industry is receiving a just return," said Mr. Frost.

The Service of the Gear Specialist

"Many gear manufacturers," continued Mr. Frost, "because of the insistence of their customers, have increased their shop equipment from time to time until they are now in a position to handle large contracts. In the meantime, many customers, possibly laboring under the impression that they are passing up potential profits by not making their own gears, are installing gear-making machinery, and possibly, in some instances, in an effort to justify the investment, juggling shop costs by sidestepping such items of overhead as supervision, laboratory expense, inspection, and cost of spoiled work.

"Then, too, instances are found where a quality of material or workmanship, or both, are permitted to go into the final assembly, that would not be tolerated in purchased gears, simply because it hurts to throw away gears made in one's own shop. The gear manufacturer must convince the gear buyer, present and potential, of the truth of these statements, and induce him to make a fairminded analysis of both quality and costs; and further, the gear manufacturer must, by improvements in materials, equipment, men, and management, so improve his efficiency that he will be able to keep his facilities employed.

The Importance of Man-power

"In our struggle to get a fair share of business and maintain a reasonable profit," said Mr. Frost, "it would seem that we as specialists ought to be the first to study more thoroughly the subject of man-power, having in mind that, in general, altogether too little thought is given to this important subject, in comparison with our readiness to spend money freely for new buildings, equipment, or sales campaigns. Certainly, it has been proved time and time again that by proper training, encouragement, and square dealing, results have been obtained that were undreamed of a decade ago.

"We should know enough of 'rough-and-ready' psychology to pick men suited, in fair degree at least, to the tasks they are to perform, and the supervision should be such that they are well instructed in any of the details of their jobs with which they are unfamiliar.

"The loss of production through accidents and the burden of compensation should also receive attention, and greater efforts should be made, from both a business and a humanitarian point of view, to safeguard employes, and to educate them to safeguard themselves against the fearful toll of life and limb that in the national aggregate is appalling."

Another subject brought up by Mr. Frost was the question of fire insurance on plant and equipment, and he urged the members to study their fire insurance policies and the subject as a whole.

Other Papers Read Before the Meeting

Papers were read before the meeting by Perry L. Tenney of the Muncie Products Co., Muncie, Ind., on "The Equilibrium Factor in Gear Shifting"; by Douglas T. Hamilton of the Fellows Gear

Shaper Co., Springfield, Vt., on "Gearing Nomenclature—Where Does it Lead Us?"; by Professor C. Z. Dickinson of the University of Michigan on "Suggestion Systems"; and by B. Wheeler of the railway equipment engineering department of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., on "Normal Pitch Measurements." At the annual dinner, an address was made by Dr. Frederick Spence, of Jackson, Mich., entitled "Some Needed Emphases in Industrial Relationships."

Progress of Standardization Work

A considerable number of reports relating to standardization were presented, and many were adopted. The following reports were adopted as recommended practices of the association: Standard Keyways for Holes in Gears; Commercial Spur Gearing Backlash; Computing the Horsepower of Non-metallic Spur Gears Composed of Laminated Phenolic Materials or Rawhide; The Design of Worm-gearing; Forged and Rolled Carbon Steel for Gears; Full-depth Tooth Systems for 14 1/2- and 20-degree Involute Teeth; Bronze and Brass Castings for Gears; Web Holes for Railway Gears; and High-speed Herringbone Gears.

A report on External Spur Gear Nomenclature was adopted as a suggested standard for future design. Several other progress reports were submitted, including one by the Spur Gear Committee, relating to tables of horsepower transmitted by standard pinions. Abstracts of these reports will be published in coming numbers of MACHINERY.

New Members of the Association

The American Gear Manufacturers' Association now has approximately one hundred member companies. Six new members were elected at the meeting, as follows: Springfield Mfg. Co., Springfield, Ohio, (William P. Metz, executive member); Federal Gear Co., Cleveland, Ohio (H. L. Stinard, executive member); Formica Insulation Co., Cincinnati, Ohio (R. W. Lytle, executive member); Copland Gear Lapping Syndicate, Detroit, Mich. (A. W. Copland, executive member); Charles E. Crofoot Gear Corporation, South Easton, Mass. (Charles E. Crofoot, executive member); and Citroen Gear Corporation, Paris, France (André Citroen, executive member).

The following members were elected to the executive committee of the association: F. W. Sinram, Van Dorn & Dutton Co., Cleveland, Ohio; H. E. Eberhardt, Newark Gear Cutting Machine Co., Newark, N. J.; A. F. Cooke, Fawcus Machine Co., Pittsburg, Pa.; and A. A. Ross, General Electric Co., Schenectady, N. Y. T. W. Owen is secretary with offices at 2443 Prospect Ave., Cleveland.

Friday afternoon the association left for Ann Arbor, where the University of Michigan was visited, and, in particular, the Department of Engineering Research was inspected. An opportunity was afforded to see at first hand what this institution has accomplished in the direction of gear research and to study the facilities available for this purpose. Several phases of gear research were touched upon, but special interest centered upon the investigations on noisy gearing. The university has an unusually well equipped laboratory for the study of noise and vibrations producing noise.

GRINDING A HOLE STRAIGHT WITHIN CLOSE LIMITS

By ARTHUR SILVESTER

The writer read with interest the article describing the grinding of a straight hole on page 530 of March MACHINERY. Having had considerable experience in grinding work, both on standard grinding machines and on lathes equipped with portable electric attachments, the writer ventures to say that trouble in obtaining straight holes as described is seldom caused by the lathe bed being out of alignment with the ways. Of course, this condition may obtain in cases where the headstock is movable, the same as the tailstock, and care has not been taken to reset it exactly in line with the ways.

Wear on the lathe ways, which results in a little side play, is the chief cause of trouble in producing straight ground holes. This wear generally extends from the extreme left-hand position to a point one foot or so from the live center and causes the hole to be ground large at the front end. Wear of this kind is quite likely to occur on small tool-room lathes which are in constant use on work that ordinarily varies from 1 to 5 inches in length.

When a cut is taken either by a boring tool or a grinding wheel in the usual manner, the tool or grinder will be pushed away from the work slightly before starting to cut, due to the fact that the worn ways allow the carriage to be forced over slightly. Trouble of this kind can, in most instances, be remedied when taking finishing cuts by allowing the tool or grinding wheel to run through the bore several times without changing its position. It will be noted, particularly in the case of the grinding wheel, that a slight cut is taken without changing the position of the tool. This action increases noticeably when the tool or grinding wheel reaches a point about 1/8 inch from the front end of the bore. The amount of stock removed will diminish with each pass of the tool or grinding wheel.

This method of finishing the bore gives as accurate results as can reasonably be expected on a lathe used for general work. In any case, a hole ground in a piece of work 3 or 4 inches long, which is not more than 0.0005 inch large at the front end, is really good work under the conditions described. There is another factor that often causes the bore to be slightly large at the mouth, namely the taking of heavier cuts than is practicable with the flexible and sensitive spindle of any grinding attachment.

The method described in March MACHINERY, previously referred to, will produce a good job, but the cost will be rather high for production work. We cannot expect to obtain as accurately ground holes by using a lathe employed for general work as by using a machine made and adapted exclusively for grinding work.

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The United States is the only important country in the world where the radio fan can listen in free of charge. In Great Britain the annual license fee for every owner of a receiving set is 10 shillings; in Sweden, \$2.70; in Japan, 80 cents; in France, one franc; in the South African Union, \$1.25; in Lithuania, \$13; and in Salvador, \$18.

Selecting the Right Machine for a Given Job

By CHESTER C. MARK

ONE of the problems of the production engineer is to select the right machine for a given operation. In attempting to increase production, the line of least resistance too often leads us astray. Special machinery is constantly being suggested as the most economical and practical means of increasing production per man-hour. It does not follow, however, that every operation requires some special type of machine to give maximum quantity per unit of time. In fact, quite often by simply transferring an operation from one machine to another of a slightly different type, the desired result is produced. The following examples show how production was increased or the cost of tool equipment reduced by changing a particular job to another machine better adapted to the work.

Forming T-head Pieces on the Bulldozer

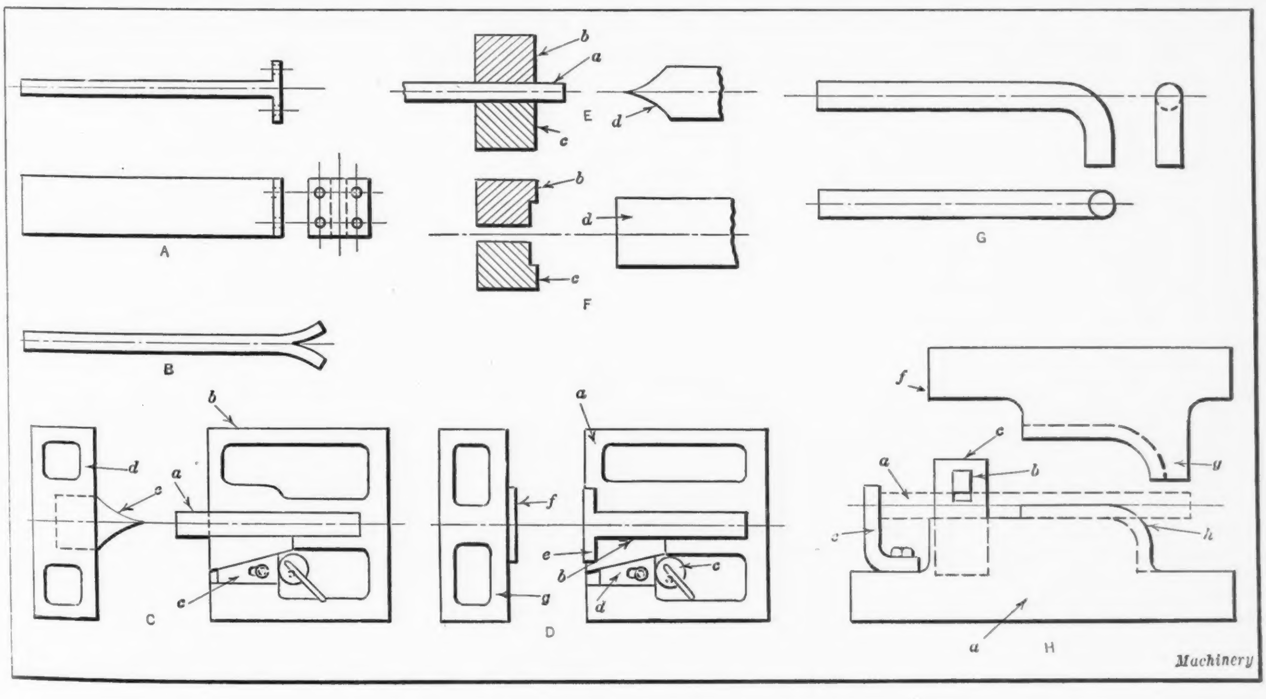
At *A* in the accompanying illustration is shown a rectangular bar, one end of which is formed to the shape of a T, with four holes through the flanges. The arms of the T-flange are approximately one-half the thickness of the main bar. Ordinarily, the bar stock would be upset and the end forged out to the required shape. However, the tool designer hit upon the idea of splitting the end as shown at *B*, and flattening the split ends to form the head in which the holes were punched. The tools designed to produce the pieces on a bulldozer are shown at *C* and *D*. The work was divided into two operations—the splitting of the end of the bar, and the flattening of the split ends.

The splitting operation was performed in the set of bulldozer dies shown at *C*. The stock *a* is clamped on the base block *b* by the wedge clamp *c* while it is split by the wedge *e*. As the ram comes forward, the wedge-shaped edge strikes the heated stock, splitting it and forming it to the shape shown at *B*, with the ends spread slightly apart. The stock is then laid aside for the second operation—flattening the ends.

The second die, shown at *D*, consists of the base block *a*, which receives the stock in the recess *e* and holds it there by the clamp *b*. Clamp *b* is actuated by the cam *c*, which, in turn, is acted upon by the wedge *d*. The split end of the stock is forced back into the recess in the die by the flat tool-steel block *f*, secured to the ram block *g*. It is apparent that the bulldozer method of producing the piece involves two operations, each requiring the stock to be heated and acted upon by two sets of expensive dies. The time for setting up the machine is not less than one-half hour per operation, and the production cost per operation, as determined by the time study, is one cent for each piece, making a total of two cents per piece for productive labor.

Forming T-head on Forging Machine

As there was a forging machine of ample size to handle the T-head pieces formed on the bulldozer as described, it was decided to transfer the work to the forging machine. It was pointed out that a single set of dies, which could be produced at about 20 per cent of the cost of the bulldozer dies, could be employed on the forging machine. The overhead expense when producing the work on the forging machine was estimated to be only 60 per cent of the cost when produced on the bulldozer, as one heating operation would be elimin-



Examples of Forging and Bending Work

ated and the work could be handled much more rapidly.

The dies designed for the forging machine are shown at *E* and *F*. These dies are known as the "double deck" type, and comprise the splitting portion shown at *E* and the flattening portion shown at *F*. The stock *a* is first placed in the gripping dies *b* and *c*, one of which is actuated by the machine. The stock is first heated, and then held by the gripping dies in a central position in line with the splitting wedge *d*. Next, the ram advances, splitting the end of the stock and spreading the two halves slightly. The piece is then transferred to the upper deck of the dies, where the end is flattened. It is held in this position by the gripping dies *b* and *c* while the ram *d* moves forward and forces the split portion back into the recess in the gripping dies.

Bending Rod Ends

Another example in which the changing of a job from one machine to another proved profitable was the bending of rod ends to the shape shown at *G* in the illustration. Often money is needlessly spent in designing and building dies for a given machine, when the work could be readily handled on another machine with regular equipment. In this particular instance, the cost of a die was eliminated, and the production rate increased by handling the bending operation on an eye-bender. The work shown at *G* is a piece of 1/2-inch round stock, with a right-angle bend at one end formed to a given radius. The cost of producing these pieces, using the set of dies shown at *H*, was fifty cents per hundred.

The dies shown at *H* function in the following manner: The straight piece of stock is laid on the die, as indicated by the dotted lines *a*, and held in this position by the wedge clamp *b*, which is driven into the slotted members *c*, secured to the side of the base *d*. The stock is located by the end gage *e*, secured to the base block. The ram block *f* is provided with a projecting lip *g*, which engages the stock and carries the end down around the corner *h* of the base block. This set of dies is adapted for use on a high-speed press of the vertical ram type, which can be inclined. The stock is heated before bending in the die.

Bending Rod Ends on Eye-bender

By transferring the bending operation from the press equipped with the die shown at *H* to the eye-bender, the cost of the die was eliminated and a better quality of bend obtained. The eye-bender was provided with an arbor of the correct diameter to give the desired radius. The bending tool was limited in its travel, in order to produce a piece of the required shape. By carrying the bend around the required distance, the "spring-back" of the stock was compensated for and an excellent job obtained.

* * *

CORRECTION

In the description of the Monarch electric spot welder appearing on pages 717 and 718 of May MACHINERY, it was stated, owing to a typographical error, that the weight of the machine is approximately 315 pounds. This should have been 615 pounds.

THE TREND IN AUTOMOBILE DESIGN

In reviewing the trends in automobile design, Thomas J. Litle, Jr., past president of the Society of Automotive Engineers and chief engineer of the Marmon Motor Car Co., at a meeting of the Indiana section of the society, said that the trend this year seems to be toward the small, high-powered, high-performance car. Although considerable discussion has arisen over the European type of small car, Mr. Litle said that he feels that this type will have little influence on American design, because the European cars are too small to appeal to Americans, and in this country we have no excessive tax on horsepower, as calculated on cylinder dimensions, and no heavy fuel tax. All cars are now being made much lower than they formerly were.

A great controversy is going on regarding the relative merits of the all-steel body and the composite wood and steel body. Metal is unquestionably stronger than wood, the speaker said, but the cost of tooling up for the production of pressed-steel bodies is so great that it can be undertaken only for cars that are produced in very large quantities. Fabric bodies undoubtedly will come into limited use because of the lightness of this construction.

Other trends are toward greater use of engine temperature control devices, such as rheostats on the cooling system to enable the car to start more quickly in cold weather; thermometers that indicate on the instrument board the temperature of the water in the cylinder block, and the removal of heat indicating devices from the radiator cap; oil filters and oil rectifiers to reduce engine wear; the placing of electric light operating switches on the steering column; better head-lamp illumination and reduction of glare; and elimination of squeaks and rumbles in the body.

The ratio of engine power to car weight has been increased in many cars to give better acceleration, especially in small high-powered cars. Low streamline bodies have brought forward a new type of axle that is very quiet, and rubber has come into extensive use to contribute to quietness.

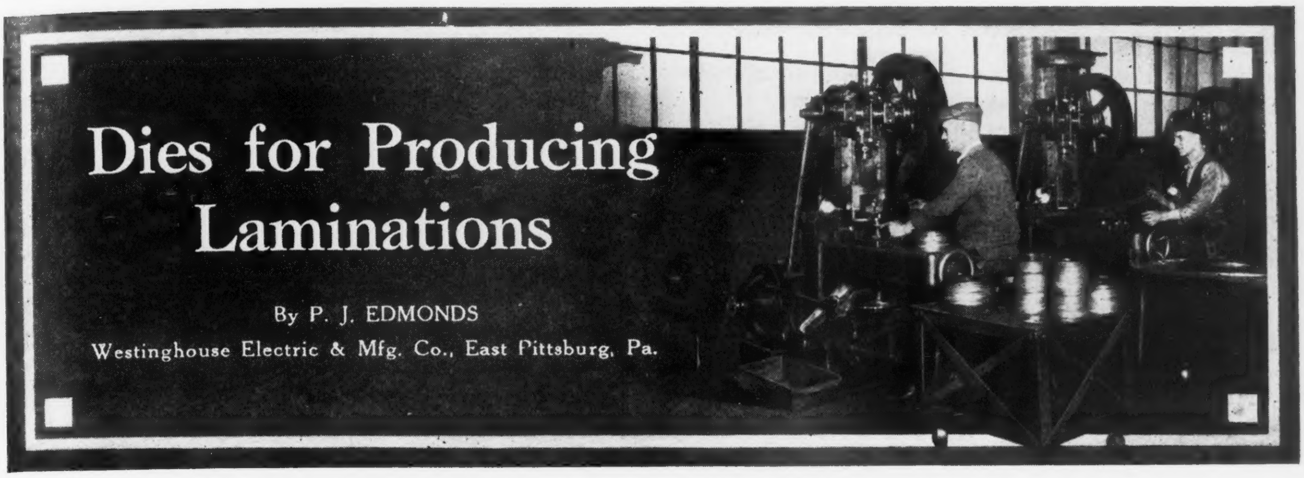
The influence of racing car design on stock cars will be seen, Mr. Litle believes, in the adoption by many companies of a general new design to increase speed. He feels certain that engines will be built to operate at higher speed as stronger alloys are available, better fuel is obtainable, and highways are better.

* * *

THE NEED FOR SHOP APPRENTICES

At the annual meeting of the Society of Automotive Engineers, H. A. Frommelt stated in a very forceful manner that there is great need for inaugurating rational apprentice-training in the automotive industry. He expressed the opinion that the present number of apprentices is not 10 per cent of what it should be. He stated from his experience that an adequate supply of apprentices would be forthcoming if suitable training methods were put into effect; that is, qualified men are not really unduly partial to white-collar jobs. Mr. Frommelt's views are worthy of most serious thought.

Dies for Producing Laminations



By P. J. EDMONDS
Westinghouse Electric & Mfg. Co., East Pittsburg, Pa.

First of Two Articles Dealing with the Design, Construction, and Application of Dies for Manufacturing Laminations Used in Electrical Apparatus

IN determining upon the type of die to be built for producing laminations used in electrical equipment, the factors of design, construction, maintenance, and economy of production should always be given careful consideration. Before these factors can be considered intelligently, production requirements must be ascertained and the design and thickness of the lamination determined. In this article, all four factors will be taken into consideration in discussing the various types of dies used to produce laminations in the metal stamping department of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa. The principles of construction embodied in the numerous dies used are based on experience that has extended over many years.

Classification of Simple Dies for Multiple Purposes

In order to expedite the manufacture of laminations for special apparatus, meet low production demands, or furnish laminations for standard apparatus before the completion of single-purpose dies, a variety of multiple-purpose tools have been constructed. With these dies, which aggregate many thousand, almost any design of rotor or stator lamination can be manufactured upon short notice by a number of simple operations. These simple dies consist of a male and a female part, and perform a single operation. The punch or male member is usually the moving part, and the female member the stationary part. These simple tools consist of round-hole, ventilating, keyway, and slot dies.

A round-hole die is used for piercing the center from a piece of sheet steel. The hole produced may be either the bore or shaft fit of a rotor or the inside hole of a stator lamination. This type of die may be inverted and used for trimming the periphery of a rotor lamination or for trimming a stator lamination to fit the frame. Round-hole dies range in size up to 36 inches in diameter.

Ventilating dies may be made either in groups or as a single die provided with a hand indexing mechanism. The center hole previously blanked in the material is used for locating the ventilating holes.

Keyway dies may be used to cut a keyway either around the bore of a rotor lamination or on the stator edge which fits the frame.

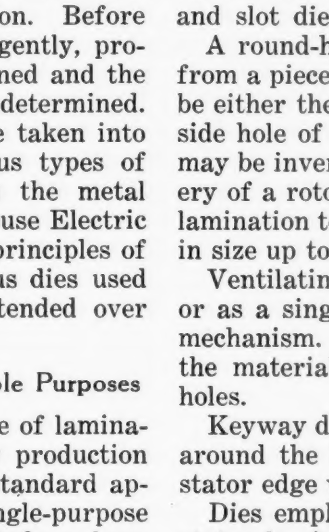
Dies employed for notching teeth on a rotor or stator lamination are set up in special automatic notching presses. The rotor lamination is placed over a plug which fits into the bore and keyway of the lamination, and the latter is held securely by friction while it is indexed for slotting. The stator lamination is placed in a ring under two spring clamps made to suit the outside of the stator iron, and this lamination is also driven at the keyway.

Certain standard dimensions of laminations occasionally present an opportunity for economy through the possibility of constructing one die to pierce the bore, vent holes, and keyway in one operation. The material is then trimmed to the proper diameter with a round-hole die, and the coil slots are notched in an automatic indexing press.

Construction of Simple Dies

When piercing a hole with a round-hole or outside trimming die, the male part is the upper moving

P. J. EDMONDS, general foreman of the Metal Stamping Department of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., was born in Birmingham, England, in 1886. He came with his parents to the United States when but two years old, and obtained his early education in Chicago, Ill., attending elementary school and evening high school in that city. He also later attended Westinghouse technical high school. In 1902 he became an apprentice with the Illinois Steel Co., and after having finished his four-year apprenticeship, went to the Westinghouse Co. as a toolmaker, later working for the Washington Steel & Ordnance Co., the Carnegie Steel Co., the National Tube Co., and the District of Columbia Paper Mfg. Co. In 1912 he returned to the Westinghouse Co. and was engaged in rate setting and time study work for nine years. For the last four years he has been general foreman in the Metal Stamping Department. Mr. Edmonds has specialized on wage payment plans, routing and production systems, and manufacturing methods. He has an expert knowledge of the design of dies for metal stamping and of economical methods of production in stamping shops. During the recent World War Mr. Edmonds served as a lieutenant in the Air Service, and was engaged in administrative work in the field forces of the Bureau of Aircraft Production.



P. J. Edmonds

member and the female part the lower stationary member. When the die is inverted for a trimming operation, the female part is the moving member and the male part, the stationary member.

Fig. 1 illustrates the most important details of a round-hole or outside trimming die. Shoe 2 is drilled and reamed to hold liner pins 10, and recessed to receive punch ring 6 and gage ring 7, which are held to the shoe by means of cap-screws. Gage plug 9 fits in the tapered hole of gage ring 7. The outside stripper consists of plate 4, which is supported by compression springs 5, and held by stripper bolts. Shoe 1 is counterbored to receive die ring 8, which is fastened in position by means of cap-screws. The inside stripper 3 is supported by stripper bolts, as shown, and held apart from shoe 1 by means of compression springs 5. Plates which fit gage plug 9 are used for locating the center hole of the work when a trimming operation is to be performed. These plates are of various diameters.

All parts of the die are made from machine steel, except punch ring 6 and plug gage 9 (which are made of tool steel and hardened and ground) and die ring 8 (which is also made of tool steel, but not heat-treated). Ring 8 is kept in cutting condition by peening the shearing edge until it is necessary to grind the surface of punch 6. When die ring 8 becomes badly worn, it can be refaced on a boring mill.

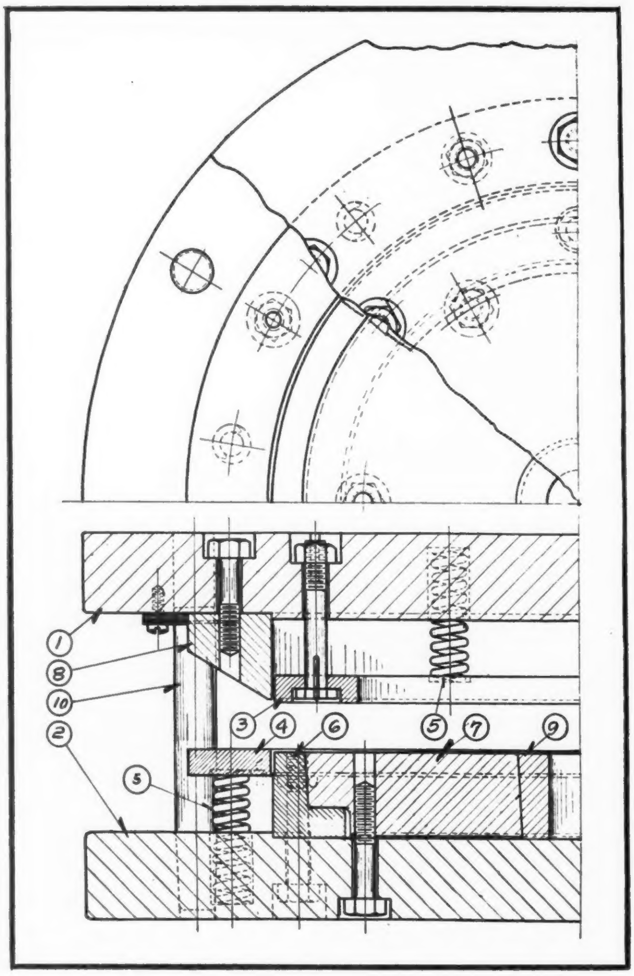


Fig. 1. Typical Round-hole or Outside Trimming Die

Fig. 2 shows a combined keyway, bore, and ventilating-hole die of simple construction. Die 5, punches 6, 7, and 8, and key 9 are made of tool steel. These parts are all hardened and ground except die part 5, which is kept in cutting condition by peening the cutting edges.

The dies for piercing the coil slots are also of simple design, as may be seen in Fig. 3. The punch is shown at the left and the die proper at the right. Both parts are hardened and ground. The heading illustration shows several special machines in which these dies are employed. These machines are set up for slotting rotor laminations, and run at the rate of from 400 to 550 strokes per minute on laminations up to 25 inches in diameter, which may contain from 25 to 100 teeth each.

General Features of Compound Dies

Compound dies are used for blanking rotor, stator, segmental, pole, and spider laminations. In dies of this classification, the female part is the moving part for cutting the outside of a lamination, and the male part is stationary; while for piercing the bore, ventilating, and bolt holes, the male part moves and the female part is stationary.

The lamination is cut between the die part carried in the upper or moving shoe and the punch held in the lower or stationary shoe. The punch also serves as a die to receive the piercing punches carried in the upper die part. The lamination is stripped from the moving part by a stripper actuated by springs, or by the ram through the lower knocker attachment. Slugs from the piercing punches are disposed of by gravity through the stationary die part, shoe, and bed.

On account of the extreme accuracy required in diemaking, and the different contours and angle to which parts must be machined, economy in die construction and maintenance may often be obtained through sectional or composite construction. The various parts of a composite die may be replaced readily if a section becomes damaged, and extra parts may be carried in stock for active dies, in order to expedite repairs.

Three Types of Compound Dies Employed

There are three types of compound dies, which have been designated A, B, and C. Type A dies are designed to produce a lamination complete in one operation, and type B dies to produce a lamination as nearly complete as is practicable in one operation. Because of die construction and maintenance, or economy in production, it is frequently desirable to perform a second operation to complete a lamination. This subsequent operation may consist of trimming the teeth on the periphery of a rotor lamination when a delicate tooth tip is required, or of piercing the center from a stator lamination. Die types A and B are used when production requirements demand quantity output.

Type C dies are constructed when the standardization of certain dimensions permit them to be used for the primary operation on a number of different laminations. A variety of laminations may be produced with this type of die by performing a subsequent operation. For example, certain rotor laminations may differ from each other only in number of teeth. Stator laminations may also differ merely with regard to the number of teeth. The outside diameter, bore, keyway, ventilation

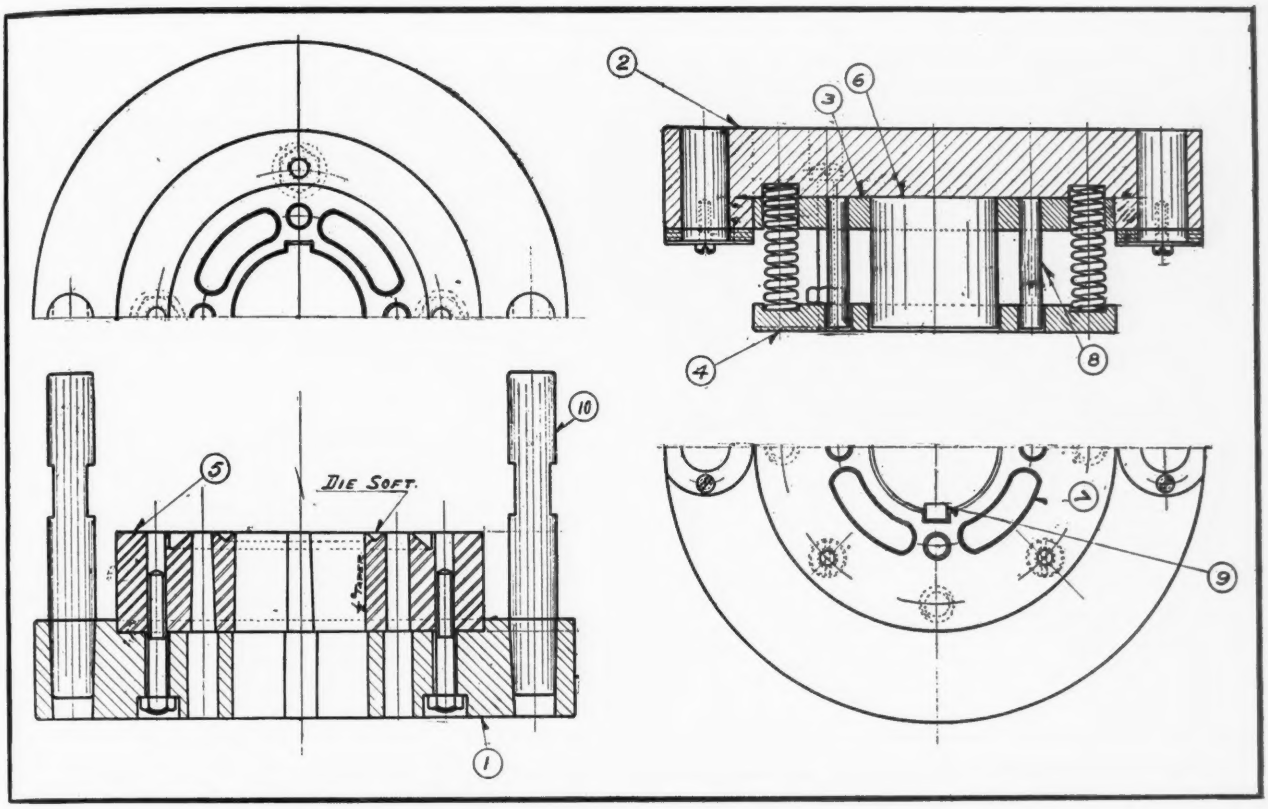


Fig. 2. Combined Keyway, Bore, and Ventilating-hole Die, of Simple Construction

and bolt holes of rotor laminations and the outside diameter or contour and bolt holes of stator laminations are standardized. A type C die is designed for economy in investment, and is employed instead of several simple dies when there is a sufficient variety of laminations, each possessing certain similar dimensions.

Types A, B, and C dies, besides being designed for the economies to which reference has been made, are conveniently operated in a press, from the viewpoint of production. The operation of picking a lamination from the sheet of material after it has been blanked is performed at the same time that another lamination is being blanked. On the return of the ram, the sheet of material is stripped from the stationary part of the die and the lamination is knocked out of the moving part, falling on the sheet of material. Then, simultaneously with the advance of the material by hand to the next position, the blanked lamination is carried from under the moving part of the die, where it is conveniently picked up by the operator, whose hands are outside of the danger zone.

Compound dies used for blanking rotor, stator, and segmental laminations are designed for material from 0.014 to 0.017 inch thick. These dies are of essentially the same construction as the dies designed for producing various other laminations. The high quality required of laminations necessitates accurate and careful workmanship in order to insure alignment of the working parts of the dies.

Since laminations must be produced practically without burrs, no clearance is allowed between the moving and stationary parts of the dies used in making laminations from 0.014 to 0.017 inch thick. When a die is first set, a slight pressure is required as the moving part engages with the stationary

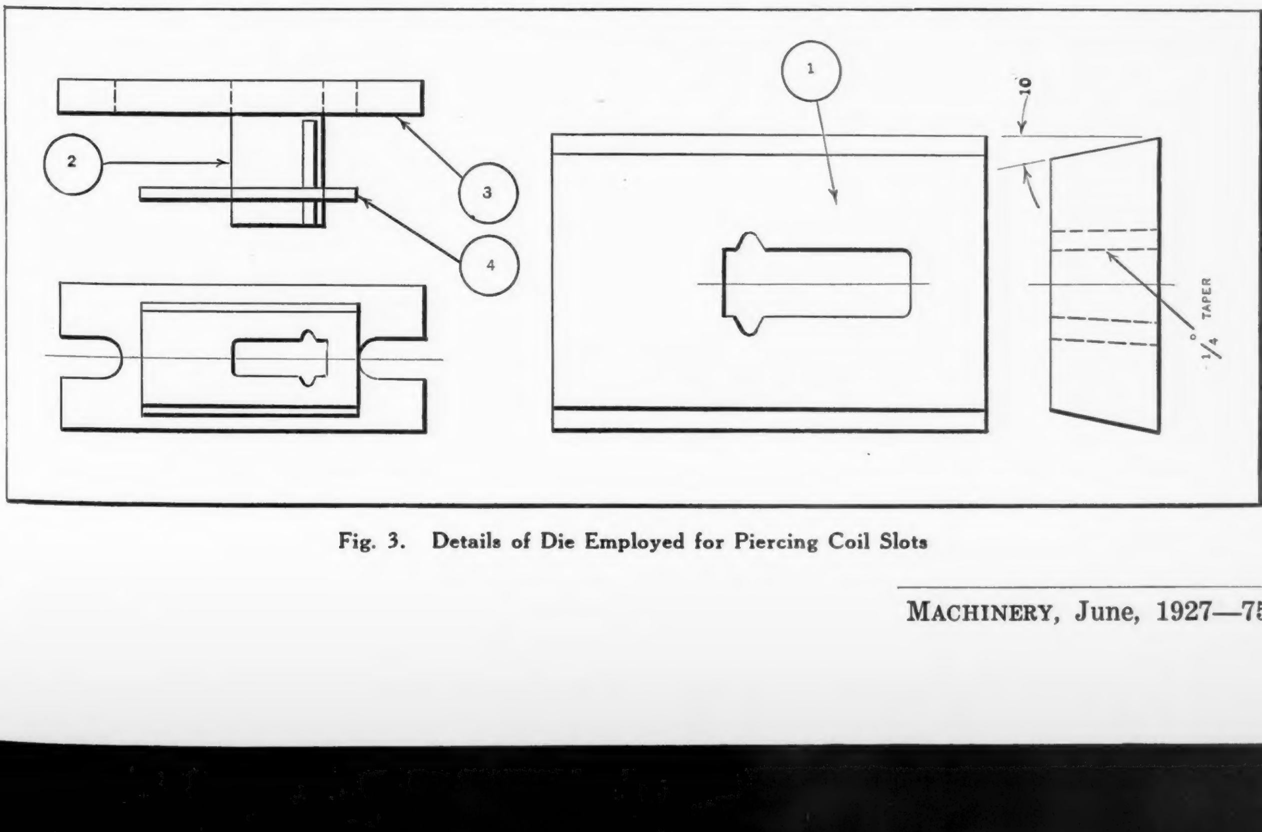


Fig. 3. Details of Die Employed for Piercing Coil Slots

part. The fit between the two parts is obtained by hammering or peening the stationary part around the cutting edges with an ordinary hammer. The hammer marks may be removed with a flat file. Any slight excess of material which may be hammered in around the cutting edges of the stationary part is sheared off when the moving

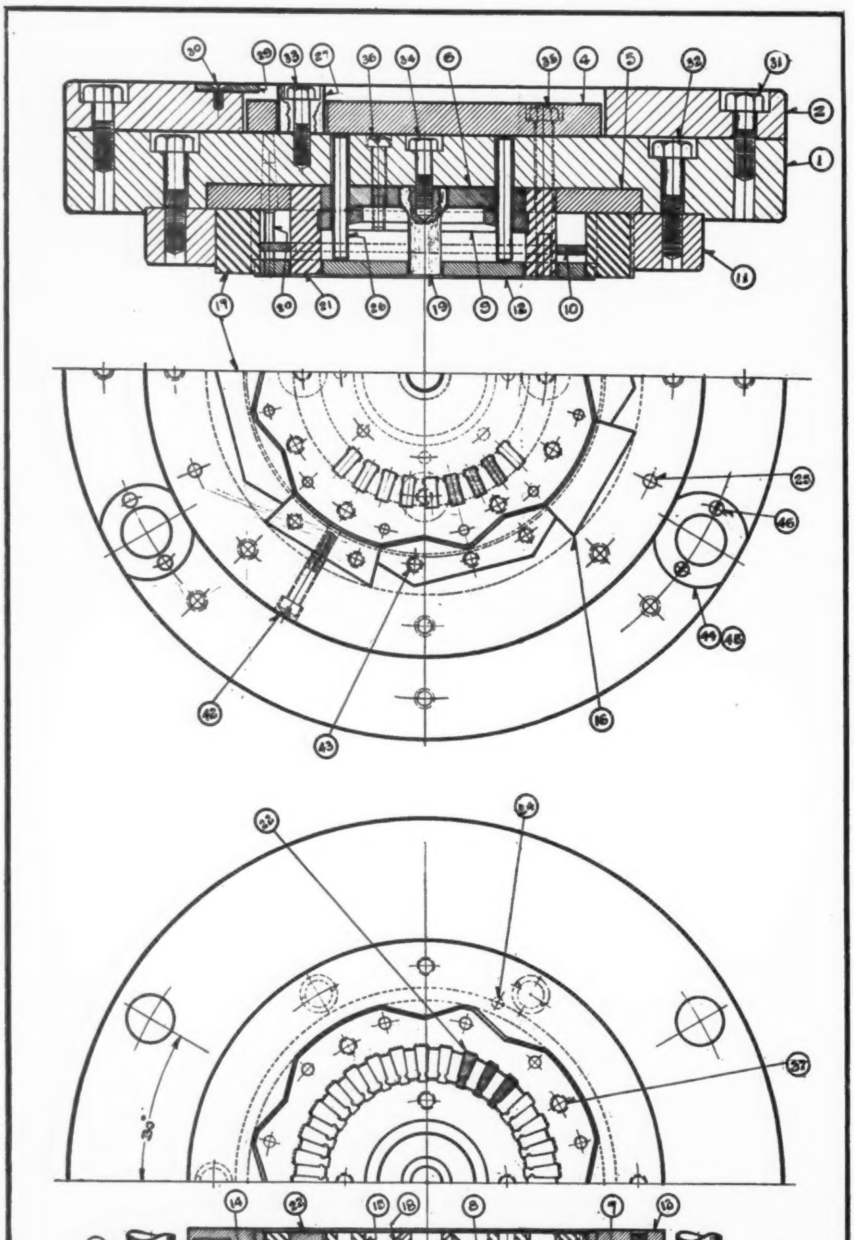


Fig. 4. Compound Die Constructed for Blanking Stator Laminations

part enters the stationary part. The latter is kept in operating condition by removing it from the press and hammering and filing any part of the cutting edge that shows excessive wear. This method is used until it becomes necessary to take the moving part of the die from the press for grinding.

The stationary part of the die is hardened only in cases where it is difficult to maintain the cutting edges, and then it is not hardened to the extent that it will resist a chisel or file. The solid section around the slots, holes, and edges is cut away at an angle of 45 degrees, but about 1/16 inch of flat surface is left around all cutting edges. Individual sections of the moving part of a die are hardened before they are assembled and are kept in operating condition by grinding.

Compound Die for Stator Laminations

Fig. 4 shows the general design of a type B compound die for blanking a stator lamination. The construction is suitable for laminations ranging up to about 30 inches in diameter. As will be observed from the illustration, a subsequent operation is required to pierce the center from the lamination. This center is used to make the rotor in a manner to be described later. The small hole pierced in the lamination by means of die part 18 and punch 19 is used for accurately locating the lamination in the die employed to pierce out the center, the hole being used in conjunction with a locating pin in the upper part of the die. This small hole is also the means of centering the disk in the same manner when the rotor is produced.

The lower part of the die illustrated in Fig. 4 is assembled on shoe 3, which is drilled and reamed to hold liner pins 23; drilled and counterbored for screws 37, 38, and 40; counterbored for compression springs 28; drilled and slotted to permit the passage of slugs; and counterbored to receive raising plates 7 and 8. These plates are machined to permit the assembly of punch ring 14, die ring 15, and die pieces 22. The die pieces rest on the solid tooth section of raising plate 8, and are held securely in position by a shrink fit between punch ring 14 and die ring 15. Die piece 18 fits in the recess of raising plate 8, and is held by means of screws 39.

This composite unit is fastened to shoe 3 by means of cap-screws 37 and 38 and dowel-pin 24. When sufficient economy in the use of tool steel cannot be obtained by making die piece 18 a separate part, the inside diameter of die ring 15 should be made the desired inside diameter of die piece 18. Parts 14, 15, 18, and 22 are made of tool steel, but are not hardened. A flat surface 1/16 inch wide is left around their cutting edges.

The bottom stripper consists of outside plate 13, which is actuated by springs 28. The plate is counterbored for these springs, and drilled and tapped for screws 40. Nuts 41 prevent the screws from working loose.

The upper part of the die is mounted on shoe 1 and top plate 2. The shoe is drilled and tapped to permit the assembly of felt washers 44, steel retaining washer 45, and screws 46; drilled and tapped for screws 31 and 33; drilled and counterbored for screws 32, 34, and 36; drilled for knockout pins 26 and screws 35; and recessed to suit punch-holder plates 5 and 6.

Die ring 11 also fits into a counterbore in shoe 1, and is held in place by means of screws 32. It is located by dowel-pins 25. Punches 21 are pressed into slots in punch-holder plates 5 and 6, and supported by distance rings 9 and 10. Ring 9 is held by screws 36, while ring 10 is a press fit between punches 21 and die pieces 16 and 17. These die pieces are fastened to plate 5 by screws 42 and 43. Punch 19 is fitted to plate 6 and held by screws 34.

Punches 20 extend through tapered holes in plate 5 and into shoe 1. Top plate 2 is fastened to shoe 1 by screws 31. The shoe and plate are assembled and drilled and reamed together for the liner pins of the lower unit. The top stripper is actuated by a knocker bar attachment, and includes knocker pins 26, stripper plate 12, and knocker plate 4 (all held in place by screws 35), distance pieces 27, and retainer piece 29. The distance and retainer pieces are held in place by screws 33 and 30, respectively. The parts of this die that are hardened before assembly are 16, 17, 19, and 21, all of which are made of tool steel. Six distance blocks 27 are used. They are intended to strengthen the unit directly over the punches.

Die of Compound Design for Rotor Laminations

A type A compound die for producing rotor laminations of the open-slot style is shown in Fig. 5. For this style of lamination, a solid punch and die section 13 constitutes the most economical design. Compound dies are used for producing rotor laminations only when the centers from the stator laminations are not available.

Shoe 3 of the die illustrated in Fig. 5 is drilled and reamed to hold liner pins 19; drilled and counterbored for screws 27; drilled and tapped for screws 25; drilled for knock-out pins 20 and bolts 26; machined to permit the escape of the slugs produced by punches 14, 15, 17, and 18; and counterbored for the combined punch and die part 13. The latter is held in position by screws 27. Bottom plate 4 is drilled and counterbored and fastened to shoe 3 by means of screws 25.

The bottom stripper, which is actuated by a mechanical knock-out, consists of knocker pins 20, stripper plate 11, and knocker plate 5. These parts are fastened together by screws 26. Lock-nuts 28 limit the height to which plate 11 can be lifted. Punch and die part 13 is not hardened. It is machined below the top, 1/16 inch of flat surface being left all around the cutting edge, as on other non-treated tool-steel parts previously referred to.

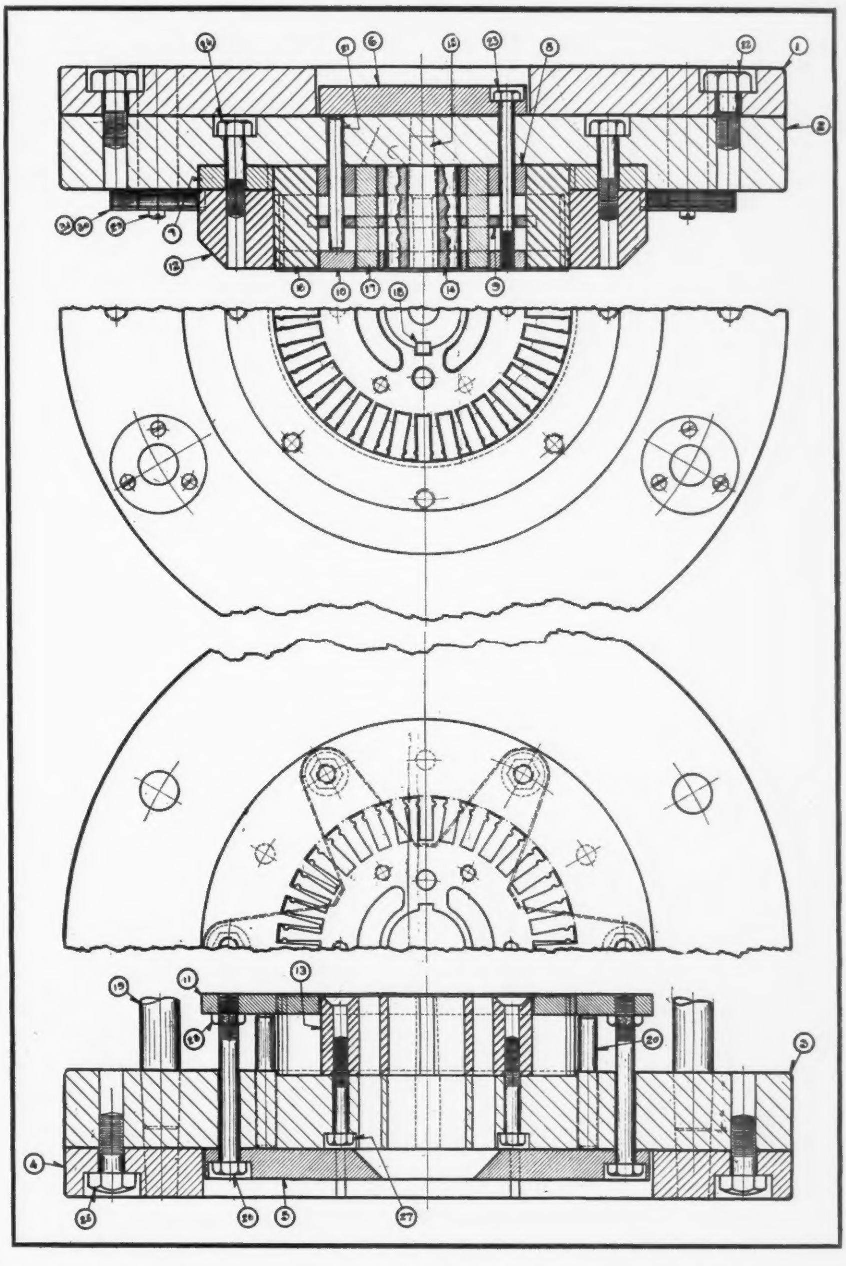


Fig. 5. Another Compound Die which is Used for Producing Open-slot Rotor Laminations

Shoe 2 of the upper unit of the die is drilled and tapped for screws 22; drilled and counterbored for screws 24; drilled for screws 23 and knock-out pins 21; and recessed to admit punch-holder plates 7 and 8. The tooth punches 16 are assembled in punch-holder plates 7 and 8 and are held against die ring 12 by distance ring 9. This distance ring also acts as a support for ventilating-hole punches 17, bore punch 14, and keyway punch 18, all of which are assembled in punch-holder plate 8. Bolt hole punches 15 are driven into tapered holes in shoe 2 and plate 8, and they are also supported by distance ring 9.

Top plate 1 is fastened to shoe 2 by means of screws 22. Both the shoe and the top plate are

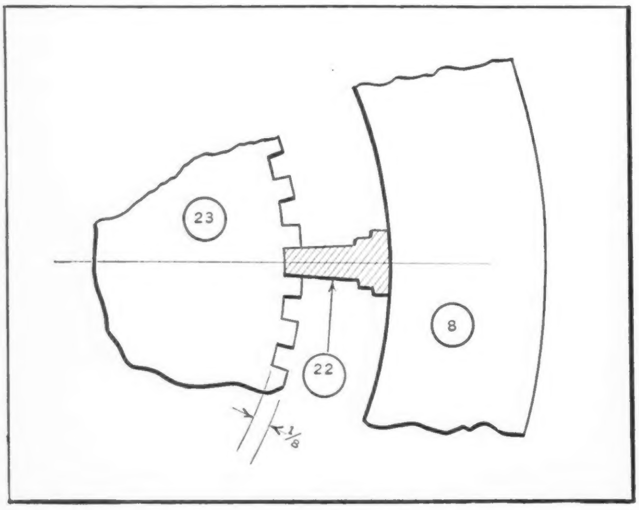


Fig. 6. Composite Construction Often Employed in Punch Design

drilled and reamed to a working fit for liner pins 19. The shoe is also drilled and tapped to permit the assembly of wiping pads, which consist of felt washers 31, iron washers 30, and screws 29.

The top stripper, which is actuated by a top knock-out for shedding the lamination, comprises top stripper 10, knocker plate 6, and pins 21. This unit is held together by screws 23 which are screwed into stripper plate 10. The sectional tool-steel parts that are hardened before assembly are 12, 14, 15, 16, 17, and 18.

On some rotor laminations the design of the teeth is such that economy can be effected by making punch section 13, Fig. 5, a composite construction instead of a single piece. In such a die, as illustrated in Fig. 6, the inner ends of the tooth punches 22 are inserted in slots of a center 23. The punches are then gripped firmly in place by shrinking ring 8 over their outer ends. On a shrinkage ring having an inside diameter of, say, 14 inches, the shrinkage allowance would be 0.030 inch. Punches 22 and punch piece 23 are, of course, made of tool steel, and part 8 of machine steel. In every other respect, this die would be of the same construction as that shown in Fig. 5.

* * *

AIR TAXIS LIMITED

A new step in the development of aerial transportation has been taken by the incorporation of a new company in England, Air Taxis Ltd., the purpose of which is to maintain flying machines, available at short notice, for carrying passengers or freight by air to any destination required. The company has issued a statement that it is prepared to carry passengers to any point in Europe and Asia at a charge of from 40 to 50 cents a mile. As an instance of the service rendered by the company, it is mentioned that a Birmingham business man was recently taken in a small two-seated airplane over a route aggregating 3000 miles in five days. The destination was some point in Russia, but business was transacted in a number of cities on the route. The fare charged was 40 cents a mile. The new venture indicates the possibilities for air transportation and the great future that doubtless is ahead for the airplane building industry—probably our next great industry.

MARKING CYLINDRICAL SURFACES WITH A FLAT STAMP

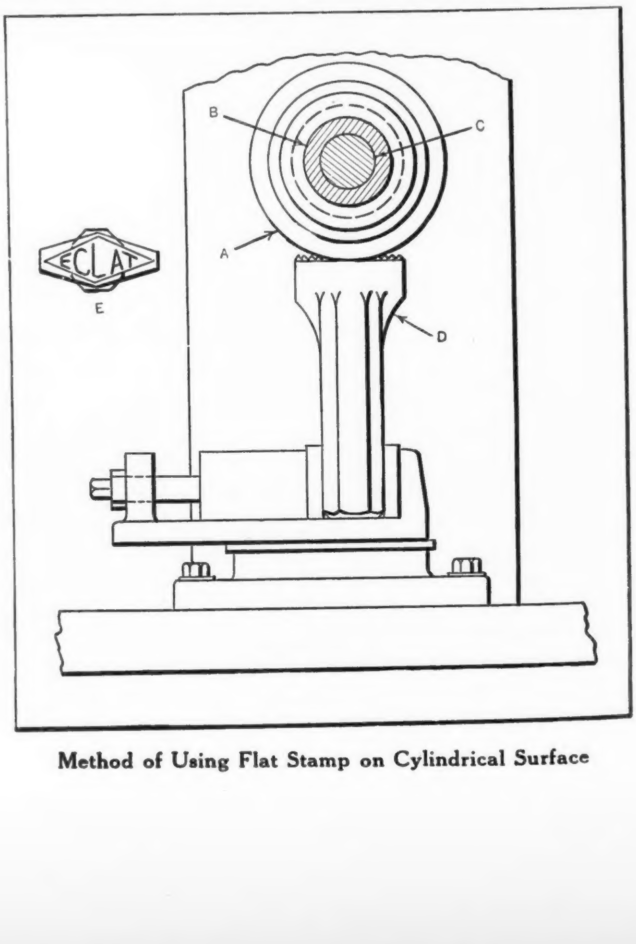
By BERNARD J. WOLFE

The most commonly employed method of marking the trade name of the manufacturer on metal cylindrical surfaces of tools and machine products, is by the use of the roller type of steel stamp or marking tool. In a certain shop, practically all the work was marked with a flat steel stamp, no marking tools of the roller type being employed.

On one occasion, however, it became necessary to stamp the trade name and certain notations on the cylindrical surfaces of some special tools, as there were no flat surfaces large enough to permit marking with the flat type of stamp ordinarily employed on the company's product. As the tools to be stamped were required for a rush order, there was not sufficient time to have a roller type of stamp made up for the job. By employing the method described, however, the flat steel stamps were made to produce the required markings on the cylindrical surfaces.

The accompanying illustration shows how the marking operation was performed on one of the component parts *A* of the tool, which is a cylindrical piece having a hole through the center. This part was mounted on a sleeve *B*, which was a running fit on the spindle *C* of the milling machine. The flat steel punch *D*, bearing the required engraved trademark shown at *E*, was clamped in the milling machine vise as shown. The milling machine table was so adjusted that the marking face of the punch was lined up with the cylindrical part to be marked. The height of the table was, of course, adjusted to give the required depth to the marking.

When the stamp *D* was fed past the work, the work was rotated in contact with the face of the stamp. This resulted in stamping the trademark on the cylindrical surface to a uniform depth, and enabled the work to be performed rapidly.



Method of Using Flat Stamp on Cylindrical Surface

Thickness of Assembled Sheets

Variations in Total Thicknesses of a Number of Assembled Sheets and Method of Determining Proper Length of Screws, Rivets, or Bushings

By J. K. OLSEN, Chief Draftsman, Stewart-Warner Speedometer Corporation, Chicago, Ill.

J. K. Olsen

IN the manufacture of certain small mechanisms and other products made largely from sheet stock by means of dies, it is sometimes necessary to place together several sheets either of metal or alternating sheets of metal and fiber or some other composition. As the thicknesses of commercial sheets vary within certain prescribed limits, there may be considerable difference between the maximum and minimum over-all thickness of a pile of assembled sheets; consequently, a screw, rivet, or bushing may be too short if made to suit the minimum thickness, or, on the other hand, it may be too long if based upon the maximum thickness. Examples from practice will be given to show, first, how the length of a screw is determined, and second, how to calculate the length of a bushing when the requirements are exacting, as in connection with certain classes of electrical work.

Length of Screw for Holding Five Assembled Sheets

The simple example illustrated in Fig. 1 will be used to show how the normal, minimum, and maximum thicknesses of five assembled sheets are determined in order to find the preferable screw length. If the nominal sheet thicknesses are merely added together without considering the tolerances, and if the nearest commercial screw length that exceeds the total thickness is used, there may never be any trouble with a simple assembly like that shown in Fig. 1, unless, due to an extreme condition, five exceptionally thick sheets happen to be placed together. It is preferable, therefore, even for the example shown, to consider the tolerances.

A standard screw of the length required for this assembly would have a plus and minus tolerance of 1/64 inch, and the nut thickness, a plus and minus tolerance of 0.005 inch. These two factors alone, therefore, would involve possible variations of 0.041 inch. If we assume that strip stock 5 inches wide is used for producing the steel and brass sections, then the steel would have a thickness tolerance of plus and minus 0.003 inch, and the brass, 0.0029 inch. If, in addition, the sheet fiber has a plus and minus tolerance of 0.004 inch, we have the variations in thickness tabulated in the following:

	Normal	Minimum	Maximum
Nut	0.125	0.120	0.130
One brass sheet	0.064	0.0611	0.0669
Two fiber sheets	0.0625	0.0545	0.0705
Two steel sheets	0.124	0.118	0.130
Total thickness	0.3755	0.3536	0.3974

For work of this class, the maximum thickness should be used in determining the screw length. As this is 0.397 inch, the next fractional screw length of 13/32 inch (0.406) would be used; hence, there would be an allowance of 0.009 inch over the maximum thickness to provide for the 1/64 inch variation in screw length.

If a screw of maximum length happened to be used with a pile of sheets of minimum thickness, the screw would project beyond the nut an amount equal to the maximum screw length of 0.421 inch minus the minimum thickness of 0.3536 inch, or 0.067 inch. If this projection of over 1/16 inch should be objectionable, a screw 3/8 inch long (1/32 inch shorter) could be used, although if this were done, the end of the screw might at times be below the surface of the nut, as when a screw of minimum length happened to be used with sheets having a maximum thickness. As a general rule, it is preferable to use a screw which at least comes flush with the nut when the total sheet thickness is maximum.

If the assembly shown in Fig. 1 were held together by a rivet, then the rivet length should be such that a strong enough head could be formed when the thickness of the assembled sheets happened to be maximum.

Calculating Length of an Insulating Bushing

The sectional view *A*, Fig. 2, illustrates an assembly that is

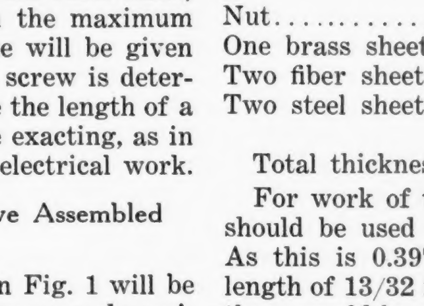


Fig. 1. Example Illustrating Method of Determining Length of Screw for Holding Five Assembled Sheets

J. K. OLSEN obtained his engineering education in Norway. Upon his arrival in the United States twenty years ago, he went to work for the Crane Co., Chicago, Ill., where he was employed for three years in machine shop work, pattern lay-out, and drafting. Later he was employed for eight and one-half years as draftsman and checker in the apparatus drafting department of the Western Electric Co. at Hawthorne, Ill., meanwhile taking courses in different phases of mechanical engineering. For the last nine years he has been connected with the Stewart-Warner Speedometer Corporation as chief draftsman, organizing and systematizing the work and designing speedometers and automobile accessories. Mr. Olsen has been granted twenty patents on inventions made by him, and has also made valuable contributions to current technical literature. He is a member of the American Society of Mechanical Engineers and a representative of this society on one of the Sectional Committees organized under the procedure of the American Engineering Standards Committee.

typical of certain classes of electrical work. The important problem in this case is to make the insulating bushing that surrounds the screw of such a length d (see enlarged diagram B) that there will be, under all conditions, sufficient clearance f and sufficient overlap g with one of the end insulators when, as the diagram shows, the bushing is against the clamping plate at the opposite end. The three bakelite insulators and the four brass contact springs which occupy space c have the following thickness variations:

	Mean	Minimum	Maximum
Three insulators	0.093	0.083	0.104
Four brass springs...	0.160	0.150	0.170
Total thickness	0.253	0.233	0.274

The foregoing figures are based on the following thicknesses and tolerances: For the bakelite insulators, 1/32 inch, or 0.03125 ± 0.0035; for the brass contact springs, 0.040 ± 0.0025. As the maximum thickness is 0.274 inch, it is evident that the bushing must be at least that long. It is important, however, to make sure that the overlap g and the clearance f will be sufficient under both maximum and minimum thicknesses, and it may be necessary to make the end insulators of thicker stock than the others to care for possible variations and insure the necessary overlap of the central insulating bushing. The procedure will be described in detail, because if minimum and maximum conditions are not considered carefully in connection with electrical apparatus, a short circuit may result.

The insulators and springs which occupy space c have a maximum thickness of 0.274 inch and a minimum thickness of 0.233 inch; hence, the total variation of 0.041 inch shows that the 1/32-inch insulators which are used in the central space c cannot be used at the ends ee. The next commercial size is 1/16 inch, which will be used in this example. It will be assumed that these sheets have a plus and minus variation of 0.0055 inch, and that the tolerance for the length d of the bushing is plus or minus 0.003 inch.

Procedure in Determining Length of Bushing

To determine the length of the bushing, the maximum thickness of the seven sheets in space c (diagram B, Fig. 2) is first added to the maximum thickness of one end insulator e; thus, 0.274 + 0.068

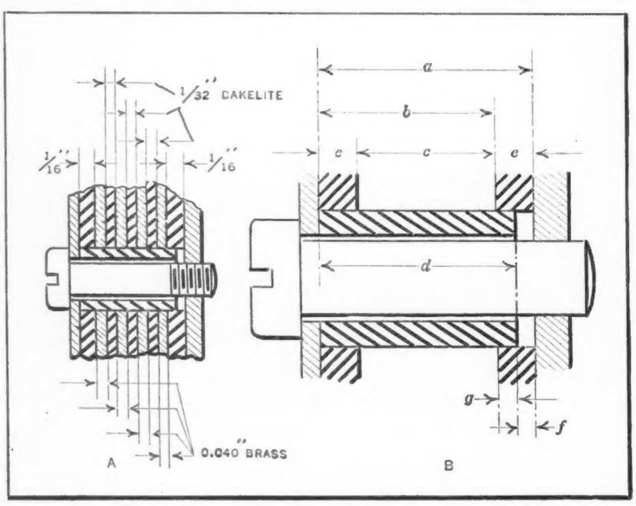


Fig. 2. Electrical Assembly Requiring Insulating Bushing of Length to Suit Minimum and Maximum Thicknesses

= 0.342. We shall assume, to begin with, that the minimum overlap g for the bushing should be 0.005 inch; then the minimum bushing length d would equal 0.347, and since the plus and minus tolerance is 0.003 inch, we have as the bushing length 0.350 ± 0.003. It must now be determined if the minimum clearance f is sufficient. The minimum thickness c plus the two minimum thicknesses e of the end insulators equals 0.233 + 0.114 = 0.347 inch. As the maximum bushing length is 0.353, there is a chance that the bushing would be 0.006 inch too long under extreme variations. This possibility of interference or lack of clearance could be cared for by increasing the thickness of the end insulators, but this thickness has already been increased, and it is assumed that further increase is objectionable. Therefore, the foregoing dimensions will be altered so as to reduce overlap g and provide slight clearance at f under extreme conditions.

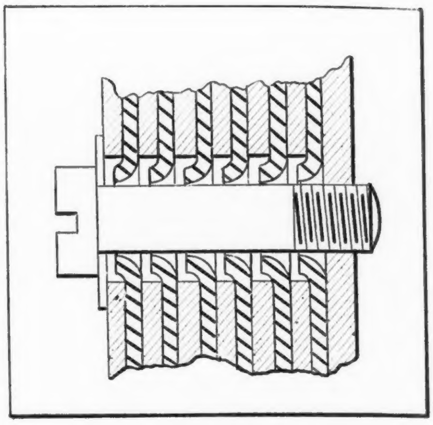


Fig. 3. Insulating Sheets Arranged to Avoid Use of Bushing

If the total plus and minus tolerances of the three center insulators, the four brass contact springs, the two end insulators, and the bushing length are all added together, the total will equal 0.069 inch. Now this total is distributed over ten parts, and it is evident that the chances of these variations all occurring in the same direction at the same time are very remote. Consequently, we may safely reduce the total tolerance 10 per cent, experience with this class of work having indicated that the percentage of reduction may equal 1 per cent for each part in the pile or assembled group. Thus, in this case as there are ten parts, the reduction is 10 per cent; if there were fifteen parts, the reduction would be increased to 15 per cent.

Method of Applying the Percentage of Reduction

The total possible variation or tolerance for the two end insulators e and the springs and insulators in space c equals 0.063 inch, and this amount minus 10 per cent equals 0.057 inch as the maximum probable variation.

Now the total thickness of the three bakelite insulators and their total tolerance equals 0.0937 ± 0.0105 inch less 10 per cent; the total thickness and total tolerance of the four brass springs in space c equals 0.160 ± 0.010 inch less 10 per cent; the thickness of one end insulator equals 0.0625 ± 0.0055 inch less 10 per cent. The total thickness, therefore, equals 0.3162 plus and minus a total tolerance of 0.026 less 10 per cent. The reduced tolerance, therefore, equals 0.026 × 0.90 = 0.0234; therefore, dimension b equals 0.3162 ± 0.0234.

As will be recalled, the bushing overlap g used for the first trial was 0.005 inch, and this is now to be reduced to 0.002 inch. Now the minimum

length d of the bushing equals the maximum length $b + 0.002 = 0.3396 + 0.002 = 0.3416$.

The dimensions will now again be checked to see if there is sufficient clearance f when dimension a is minimum. The minimum for a equals 0.3504; thus b was found previously to equal 0.3162 $\pm$ 0.0234, hence, minimum b equals 0.2928 inch. Thickness e (when tolerance of 0.0055 is reduced 10 per cent) equals $0.0625 - 0.0049 = 0.0576$; therefore, minimum a equals minimum b, or 0.2928, plus minimum e, or 0.0576, equals 0.3504 inch.

Now we found previously that the minimum length d of the bushing is 0.3416, and as there is a total plus and minus tolerance of 0.006, the maximum length d equals 0.3476 inch. It is evident, then, that the minimum clearance f equals minimum dimension a, or 0.3504, minus maximum bushing length d, or 0.3476, equals 0.0028 inch, which should be a satisfactory minimum clearance.

Checking back now to see what bushing overlap g is obtained under normal thickness conditions, we find that the normal dimension b equals 0.3162 and subtracting this from the normal bushing length 0.3446, we find that the normal bushing overlap equals 0.0284 inch.

If the construction represented at *A*, Fig. 2, were employed for a larger pile of sheets, it might be necessary to have in stock bushings of different lengths for use in connection with selective assembling. This method, however, is objectionable, and should not be used unless the foregoing method of calculating the bushing length has been applied and proved unsatisfactory.

In determining the required screw length, the method previously described in connection with Fig. 1 would be employed; that is, the screw is given sufficient length to bring the end flush with the outer surface of the clamping plate when the total thickness is maximum, the screw being allowed to project through whenever the thickness is less than maximum.

A simpler and cheaper design that is sometimes used is shown in Fig. 3. The insulators are embossed somewhat around the screw, thereby eliminating the bushing and also the heavy end plate insulators which are replaced by insulators of the same thickness as the ones used throughout. Since the bushing is omitted, this assembly involves less work in design, and the screw length can be determined as previously described. The main reason why this design is not always used is because it is more difficult to control the positions of the parts, which do not line up as accurately as when a solid bushing is used.

The general method of figuring, as shown in this article, is applicable to almost any product having a "pile-up," as, for example, the laminations used in electrical coils or the laminated armatures used in small motors.

The typical construction shown in Fig. 1 is used in many different designs; for instance, where two halves are clamped together with a partition or screen with gaskets between the members, as in lubrication or gasoline lines. Materials other than fiber are often used, such as asbestos or cork, in which case the total variation is considerably greater than in the example shown in Fig. 1. The types of construction represented by Figs. 2 and 3 are commonly employed with such electrical apparatus as switchblocks or jacks used in radio and telephone apparatus.

* * *

AUTOMOTIVE ENGINEERS' MEETING

The spring meeting of the Society of Automotive Engineers was held at French Lick Springs, Ind., May 25 to 28. Sessions were devoted to the following subjects: Chassis, headlighting, research, engines, body design, and brakes. Four papers were scheduled for the research session. The "Relation of Research to Industry" was covered by W. S. James, research engineer of the Studebaker Corporation of America, formerly with the Bureau of Standards. This paper continued, along slightly different lines, the thought developed in the paper on "Tendencies in Research at Engineering Colleges" presented at the annual meeting by Dean A. A. Potter and Professor G. A. Young. H. K. Cummings of the Bureau of Standards reported on the recent results of the joint fuel research committee, this report covering a comprehensive analysis of anti-knock fuels.

Four-speed transmissions would be more generally adopted if production men could guarantee that such transmissions, produced in quantities, would operate quietly in third speed. S. O. White of the Warner Gear Co. reported at the chassis session the findings of his company in regard to the design and production problems encountered in the four-speed transmission. Following the presentation of this paper, a demonstration was staged of passenger cars equipped with different types of four-speed transmission.

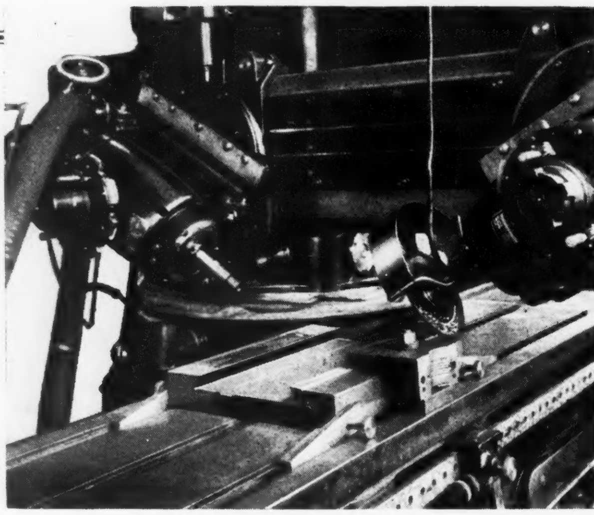
Four papers were presented at the brake session. H. D. Church of the White Motor Co. discussed "Internal Brakes." Mr. Church's paper was based on the results of a comprehensive study of internal brakes, and gave specific information as to details of construction.

With the general adoption of four-wheel brakes, the testing of brake lining has become an important subject. In January, 1922, S. Von Ammon, of the Bureau of Standards, presented a paper on the testing of brake lining by the use of a machine developed by the bureau. Subsequently the Society of Automotive Engineers Brake Lining Subdivision under the chairmanship of Clarence Carson, now chief engineer of Dodge Bros., Inc., studied the subject intensively. Another type of machine was developed by Mr. Carson, and several machines of this type were built by brake lining manufacturers. However, the tests on the Carson machine differ materially from the tests on the Bureau of Standards machine. In order that passenger-car engineers might benefit by the knowledge gained through these tests, Mr. Von Ammon had collected the test data compiled by the bureau and by the users of the Carson machine and presented an analysis of the test data that will serve as a new guide-post in brake lining testing.

F. W. Parks of the Cowdrey Brake Tester Organization, presented a paper covering the desirability of including in the production assembly line a machine that will, by the use of individual dynamometers for each wheel, permit proper equalization and adjustment of brakes.

Grinding Ways and Slides

By L. SICHEL*



IN fitting the ways and slides of machine tools or similar parts of other machines, it is essential to produce surfaces that are accurate planes and properly located both as regards angular and relative positions. In the development of a machine for grinding such surfaces, the aim was to obtain, in addition to the necessary degree of precision, equipment capable of grinding ways and slides on a commercial basis. The machines finally designed for this work not only meet these requirements, but are capable of duplicating within close limits any part previously ground, and the range of work may vary from a small slide or gib up to a 30-foot bed for a lathe or other machine tool.

Machines Used for Way and Slide Grinding

Two general types of way grinders have been constructed. One design has a traversing work-table, whereas the other type has a fixed work-table and a traversing grinding head. These two types of machines are built in Germany by Schmirgelwerk Dr. Rudolf Schoenherr, Chemnitz, Germany.

Fig. 1 shows the traversing table type, which is the most recent design, and Fig. 2 is an end view of a traversing head machine. Angular ways and comparatively narrow surfaces are ground by means of two swivel heads *A* and *B*, which may be set at any angle from the horizontal to the vertical. When wide horizontal surfaces are to be ground, the large segment-wheel head *C* is used. The massive arm *F* which supports these three grinding heads swings about a vertical axis for locating either heads *A* and *B* or the segment-wheel head *C* in the grinding position. A positive stop near the base of the column serves to locate the arm accurately in either of these two positions.

The diagram in the upper left-hand corner of Fig. 3 represents a typical application of the segment-wheel head, whereas the other diagrams indicate the wide range of work for which the angular heads *A* and *B* are adapted. Cup and saucer wheels are used for these angular and flat surfaces. The angular heads are provided with very sensitive spirit levels, there being eight levels equally spaced around circular holders *D* and *E*. (See Figs. 1 and 4.) These levels are adjustable, and each one is set to a level position after the head is adjusted to whatever angle may be required.

For example, if one of the levels is to be used for a 45-degree angle, the head is first set to this angle by means of a sine bar, and then the sensitive level is adjusted. Subsequent settings of the head to this angle are made by merely turning it until the level indicates that it is in the 45-degree position. The machine is equipped with additional spirit levels of the precision or sensitive type, and this system of levels in conjunction with adjustments for the work-table makes it possible to maintain the required standards of accuracy and grind duplicate parts within very close limits.

Each of the three grinding heads is driven by an individual motor of the built-in type. These motors are controlled by conveniently located switches. The heads are equipped with both approximate and fine adjustments for the angular and longitudinal adjustments to facilitate making changes for different classes of work.

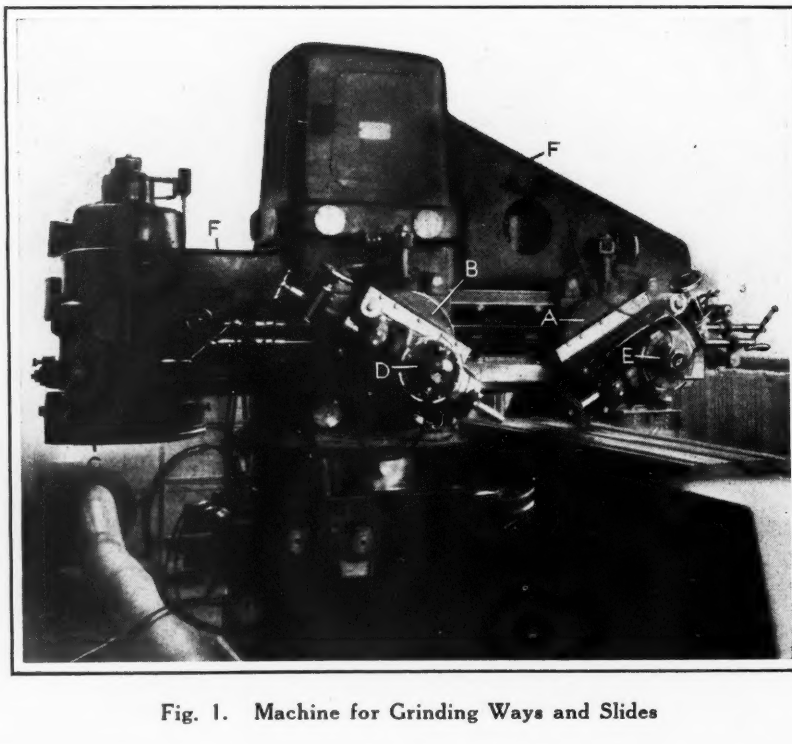


Fig. 1. Machine for Grinding Ways and Slides

*Address: 200 Fifth Ave., New York City.

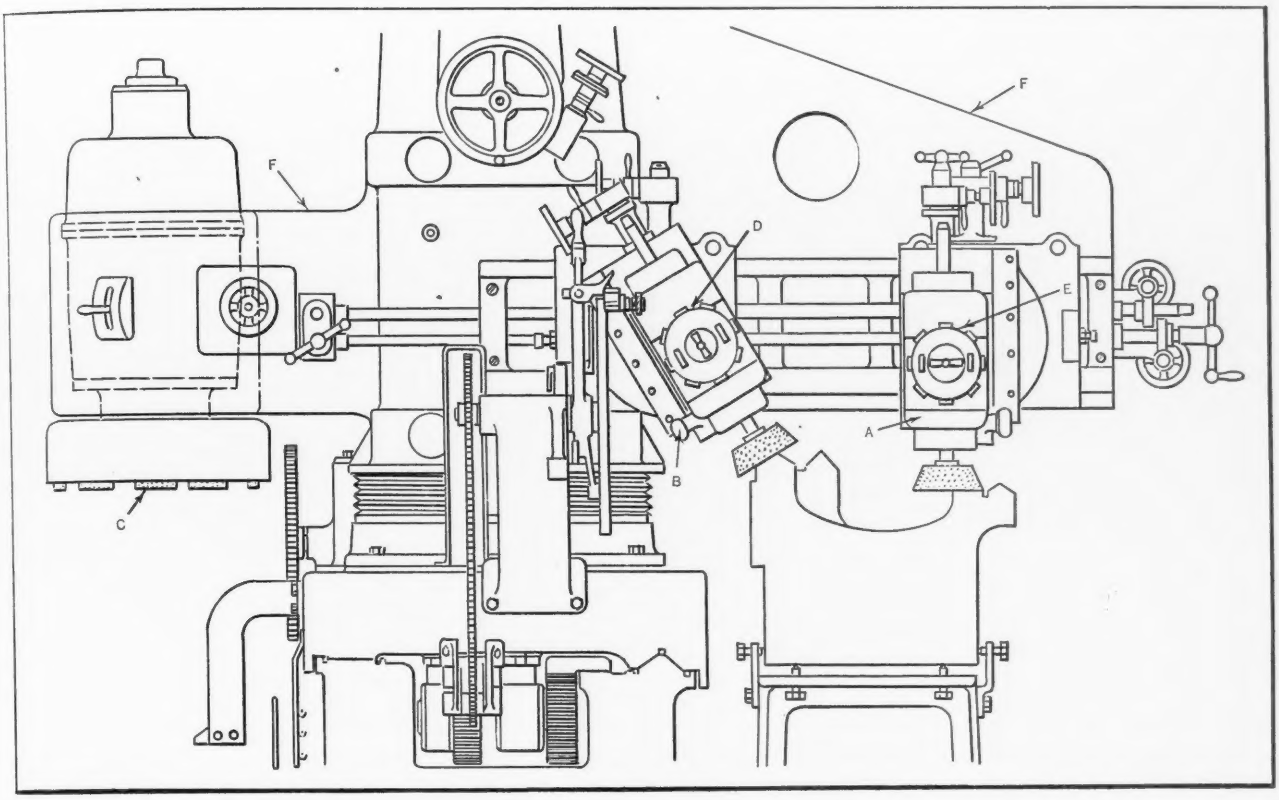


Fig. 2. End View of Way Grinder of Traversing Head Type, Showing Application to Lathe Bed

General Method of Setting up Work

In planing or milling castings preparatory to grinding, it is important to avoid unnecessary clamping strains, as the resulting distortion of the casting requires the removal of additional metal in grinding, thus increasing the grinding cost unnecessarily. As to the grinding operation itself, practically no clamping pressure is required, especially if the castings are quite large. When milled or planed castings have little or no wind and the ways are neither convex, concave, nor tapering to a marked degree, the grinding time will be greatly reduced and may be little more than is required for removing the tool marks. Of course, if the work is quite long, the amount of inaccuracy to be removed in grinding is increased proportionately, as a rule.

The milled or planed casting to be ground is first aligned horizontally and vertically, preferably by using an ordinary dial indicator. This indicator is fastened in an attachment on the grinding heads and is adjusted to the work, which is traversed to test the alignment.

Fig. 5 shows a gang of machine tool slides set up for grinding. The segment-wheel head is in position for finishing the upper surfaces. The

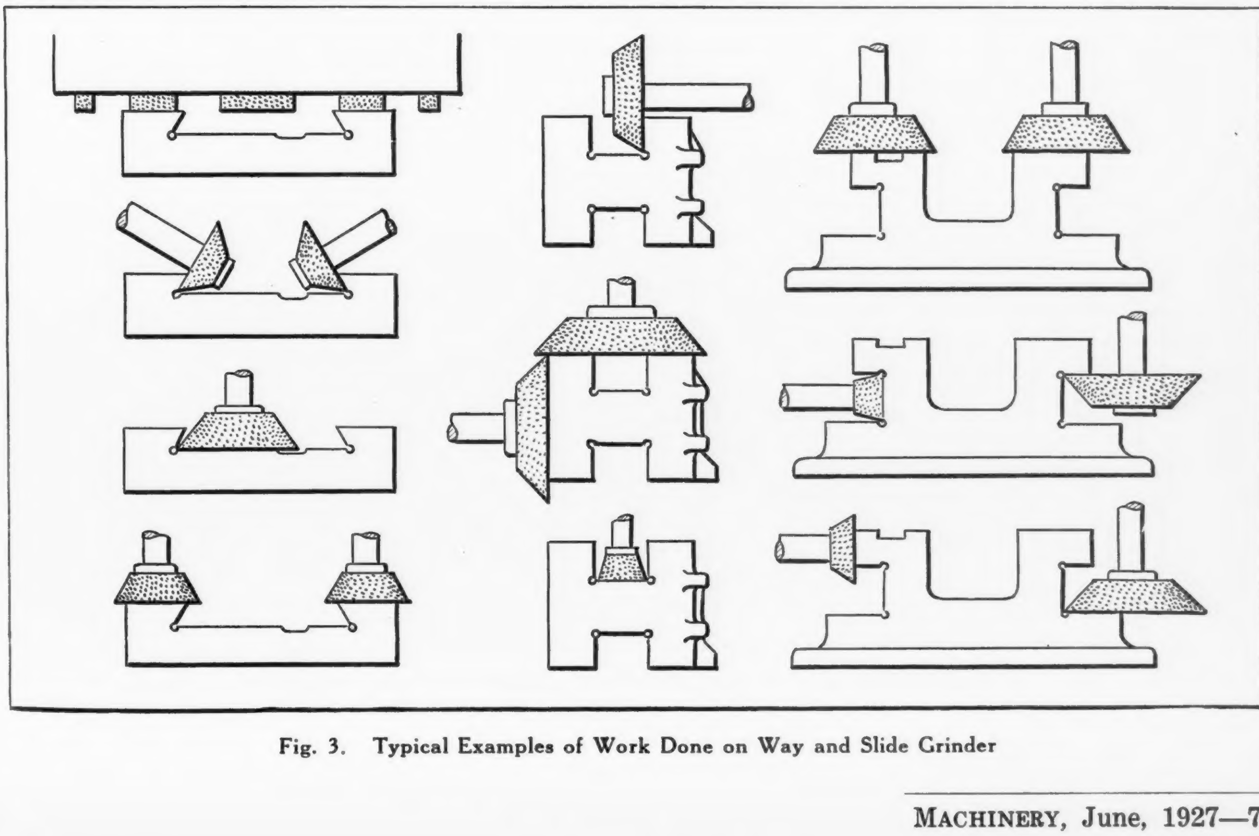


Fig. 3. Typical Examples of Work Done on Way and Slide Grinder

typical style of adjusting screws used may be seen in this illustration. These screws hold the slides laterally, and any slight differences in height may be cared for by using pieces of tissue paper, the castings having previously been selected with regard to thickness. Another method is to place the castings on the grinder in the same order that they occupied on the planer or milling machine. On very heavy work, such as machine beds, etc., jackscrews are used for leveling the work. The end view, Fig. 2, which represents a machine bed in the grinding position, shows the screws used for the vertical and lateral adjustments. By testing the machined surfaces with the indicator in the grinding head, a casting may easily be set so that only a minimum amount of metal need be removed in grinding.

The accuracy of ways as regards included angle between surfaces or relative positions may be tested by different forms of master gages in conjunction with marking materials, such as Prussian blue, etc.

Way grinding ordinarily is done dry, as this operation replaces scraping and a very small amount of metal is removed in truing the previously machined surfaces. In way grinding, the use of a cooling compound on the wheel does not have the advantages incident to other grinding operations, as the cuts are light; moreover, a cooling compound may be undesirable, as for example, when the work being ground is partly or entirely assembled, so that there is danger of the compound getting into some part of the mechanism. Way grinders have been in use for several years without exhausters, and it is claimed that no damage has resulted to either machine or operators; however, the dust may be exhausted if preferred.

Quality of Work and Grinding Time

The ground bearing surfaces obtained with the equipment described show a large area of contact when tested with Prussian blue or some other suitable marking material in conjunction with a master gage. The minute marks left by the grinding wheel, although almost microscopic, provide good lubricating channels, although for moving parts oil-grooves are desirable, the same as for scraped surfaces.

The time required for grinding naturally depends upon the allowance for the grinding operation and the accuracy of the planed or milled surfaces. The allowance for grinding need not exceed the amount that is customary for scraping, although this allowance must necessarily be related in any case to the quality of the prior machining operations. As one example of the time required for grinding, a 16-foot lathe bed was ground in 7 2/3 hours. The allowance in this case, however, was 0.012 inch, which is much more than a good planing department would allow for scraping.

No difficulty is experienced in grinding mating parts, such as beds and saddles, to a perfect assembly fit without further hand work, and this also applies to smaller slides and other parts. The heading illustration shows the machine arranged for grinding a gib, and the general method of applying it to various other classes of work requiring accurate fits between interchangeable parts will be apparent to those familiar with machine shop practice.

* * *

PHOTOGRAPHY OF BULLETS IN FLIGHT

The first photographs of projectiles in flight were taken by Professor Ernst Mach of Prague about 1881. In recent experiments, Philip P. Quayle of the United States Bureau of Standards has been able to take photographs of rifle bullets in as many as seven stages from the muzzle to a distance of 11 inches from the end of the muzzle, all within 0.0005 second. Briefly, the method used is to produce, by the light of a strong instantaneous electric spark, a direct shadow of the bullet on a photographic plate. The spark is timed to appear just at the moment when the bullet is in front of the plate, and must be instantaneous to produce a sharp shadow picture. A projectile moving at 2700 feet per second would be in front of a plate 8 by 10 inches only for a period of about 0.0003 second. To produce a sharp picture, however, the exposure must not exceed 0.000002 second. A detailed account of the methods used and illustrations of photographs taken will be found in Scientific Paper No. 508 of the Bureau of Standards on "Spark Photography," obtainable from the Government Printing Office, Washington, D. C.; price, 20 cents.

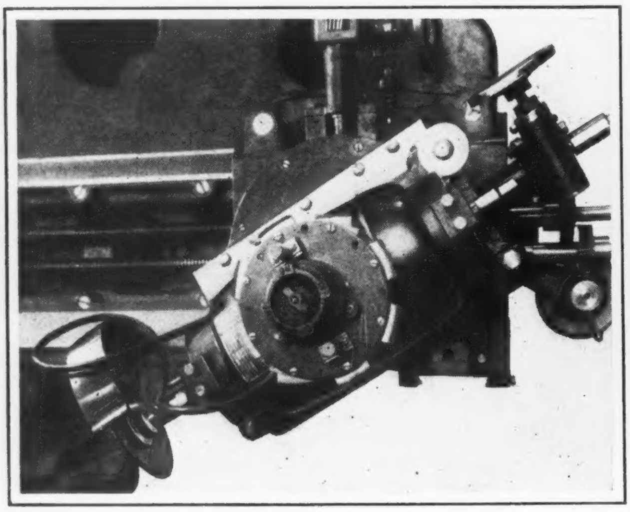


Fig. 4. One of the Wheel-heads of Machine Shown in Fig. 1

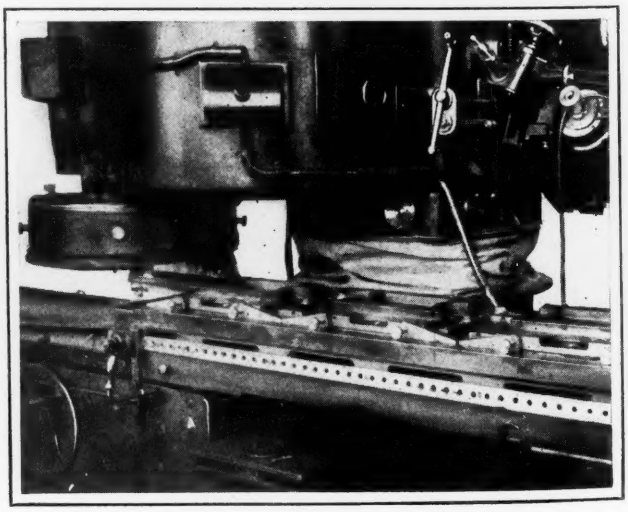
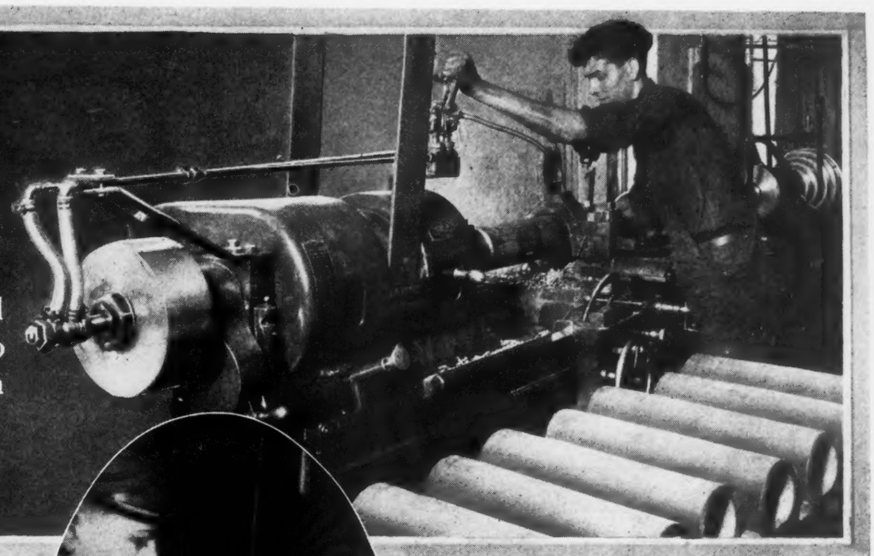


Fig. 5. Grinding Upper Surfaces of a Gang of Slides with a Segment Wheel

Air Chucks and Fixtures

Pneumatically Operated Equipment Designed to Save Time and Labor in Quantity Production



First of a Series of Articles

CONSERVATION of time and energy is the principal advantage derived from the use of air-operated equipment on machine tools. Clamping members are instantly applied or released by merely operating a valve lever, and movements of this lever are made throughout the working day without fatiguing the machine attendant. In addition to these advantages, however, the work is always gripped with the same amount of pressure in an air-operated chuck or fixture, and hence, uniformity of the work is more easily attained.

Still another advantage mentioned by manufacturers of this class of equipment is that the air in the cylinder acts as a cushion for the gripping mechanism and prevents it from being damaged by shocks. If work held in an air chuck should start to slip, a greater pressure would instantly be built up in the cylinder to make the chuck jaws grip more firmly.

The standard air equipment made by the Hannifin Mfg. Co., Chicago, Ill., meets most of the needs of this concern's customers, but there are many instances when special chucks or fixtures must be designed. This series of articles will deal with a large number of special devices built by the company mentioned. Each example has been selected because of some interesting feature of construction. The pistons provided with special equipment are generally standard, but the cylinders are made to suit each job, both as respects the length and the manner of mounting. The equipment is usually designed for operation with an air pressure of from 70 to 80 pounds per square inch.

Chuck for Holding Automobile Pistons in a Lathe

Equipment of the general design illustrated in Figs. 1 and 2 has been furnished to quite a number of automobile concerns for holding pistons in lathes and other machines. The design illustrated is provided with a 5 1/2-inch double-acting floating cylinder *A* of the rotating type. Hollow tube *B* supports the cylinder, extending through the regular spindle of a standard lathe. The cylinder piston is connected to rod *C*, the other end of which is fastened to pin *D* in the center of the chuck. At the forward end, the hollow tube is connected to sleeve *E*.

When the air valve lever is operated to admit air into the cylinder on the forward side of the piston, the piston and rod *C* pull pin *D* to the left and, since the cylinder is full-floating longitudinally, the cylinder itself, tube *B*, and sleeve *E* tend to push toward the right. The movement of pin *D* causes two jaws *F* (see also Fig. 2) to move radially outward against the inside of the work, and the movement of sleeve *E* causes three pins *G* to function in a similar manner. Thus, the work is held firmly for the operation. Driving of the work is effected by the bosses of the piston-pin holes coming in contact with the body of the chuck.

When the valve lever is shifted to admit air in back of the cylinder piston, the action is the reverse of that described, jaws *F* and pins *G* being withdrawn from contact with the work. To insure that these parts will withdraw readily, jaws *F* are provided with flat springs *H*, Fig. 1, and pins *G* are connected by three coil springs *J*, Fig. 2. Since both the cylinder and piston move when air is admitted into the cylinder, neither the jaws nor the pins exert pressure on the work until they all act together. The pressure of the pins and jaws must not be so great as to expand the skirt of the work, and for this reason, a regulating valve is provided to insure just the proper amount of pressure. The air piston has a stroke of 1 inch, and the cylinder moves approximately 5/8 inch horizontally when the work is gripped or released. Chucks of this construction have been made for holding both cast-iron and aluminum automobile pistons.

Expanding Mandrel for Pressed-steel Cups

Pressed-steel cups 9 3/8 inches in diameter by 8 inches long, formed of material 1/2 inch thick, are held on the mandrel illustrated in Fig. 3 while a lathe tool is advanced to cut off the closed end so

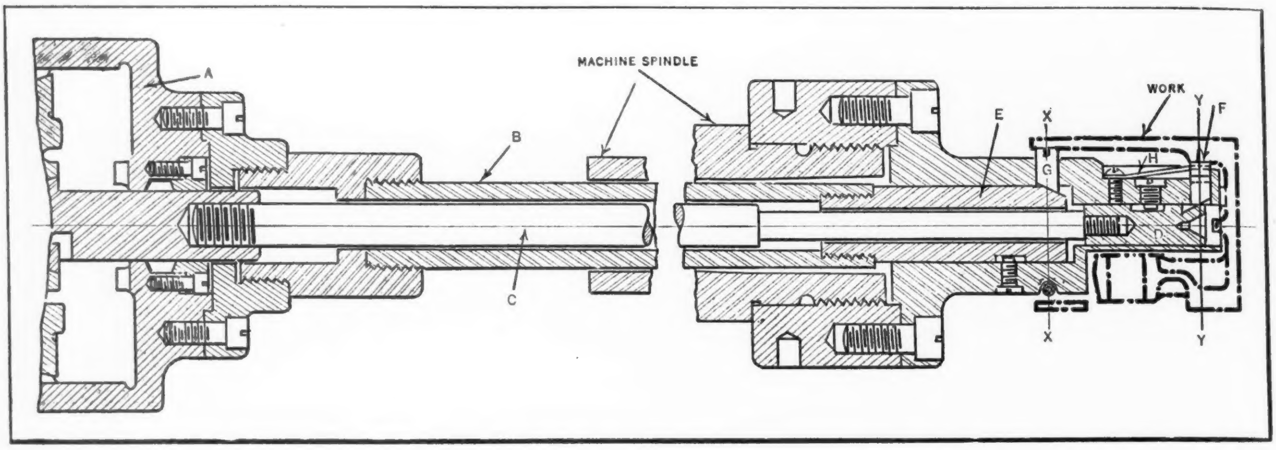


Fig. 1. Air Equipment Designed to Hold Automobile Pistons in a Lathe or Similar Machine Tool

as to form a tube as shown. The air cylinder and piston provided for this mandrel are similar to that illustrated in Fig. 1, with the exception that the cylinder is fastened to prevent longitudinal movement. When air is admitted in front of the piston to force it toward the left, the taper portion of plug *A* forces eight blocks *B* radially outward against the inside of the cup. The mechanism, of course, operates in the reverse manner when air is admitted in back of the piston to release the work.

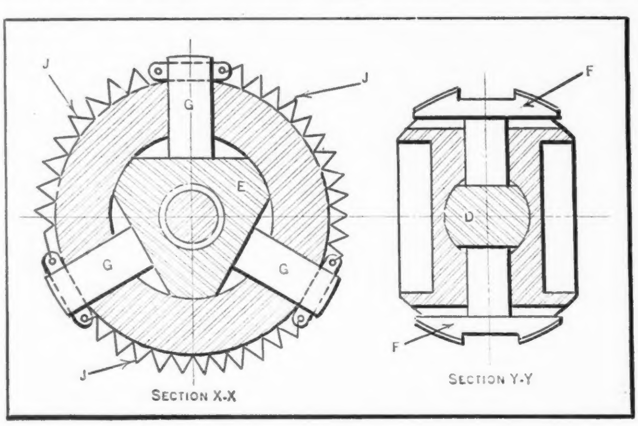


Fig. 2. Sectional Views of the Piston-holding Chuck Shown in Fig. 1

Coil springs contained in grooves *C* and *D* connect all blocks *B* and withdraw these blocks into their slots when the piston and plug *A* are operated to release the work. Nuts *E* can be adjusted in and out to bring them in contact with the closed end of the cup and thus locate the part for the operation. There are many applications for mandrels of this design.

Indexing Types of Fixtures

The fixture illustrated in Fig. 4 has been designed to hold three pieces of tubing while they are slotted simultaneously on the ends in a hand milling machine. Six slots are cut in one end of each piece, and then the pieces are turned end for end in the fixture and a similar number of slots cut in the opposite end. There are three separate air cylinders, one for each unit of the fixture, and the pistons of these cylinders are operated in unison.

After each tube has been placed in a bushing *A*, air is admitted into space *B* of the corresponding cylinder to move piston *C* forward. In this movement, nose *D* expands the slotted portion of collet *E* against the inside of the tube to hold it securely for the operation. Air is, of course, admitted into space *F* to push back the piston and plug *D* for releasing the work.

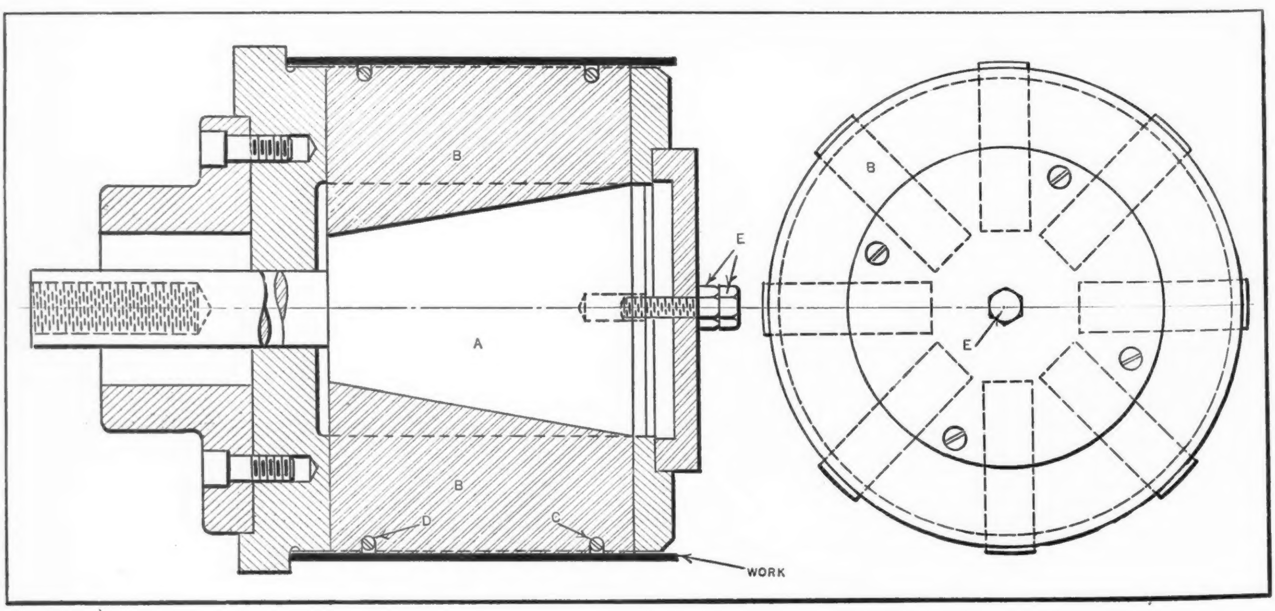


Fig. 3. Expanding Mandrel Designed to Hold a Pressed-steel Cup

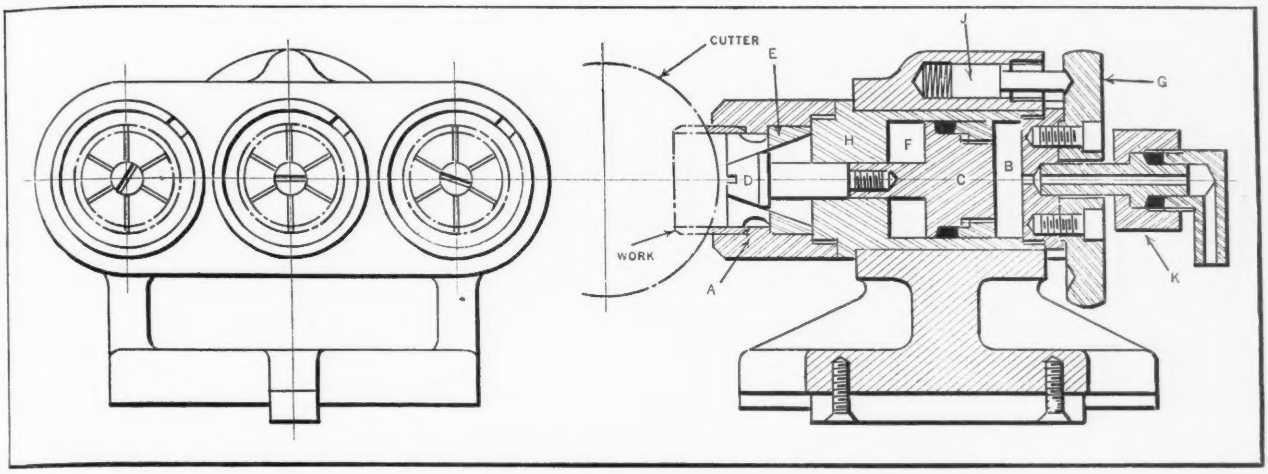


Fig. 4. Indexing Type of Fixture Employed in Slotting Small Pieces of Tubing

Two slots are produced in the three pieces of work with each movement of the fixture past three cutters mounted on the machine spindle. Between each feeding movement of the fixture, handwheel *G* is revolved 60 degrees, and this movement is imparted through gears to each cylinder *H* and bushing *A* to index the pieces of tubing. Spring plunger *J* engages holes spotted on one face of handwheel *G* to insure accuracy of the indexing. Air connection *K* is of a swivel design to permit free indexing of the handwheel and the cylinders.

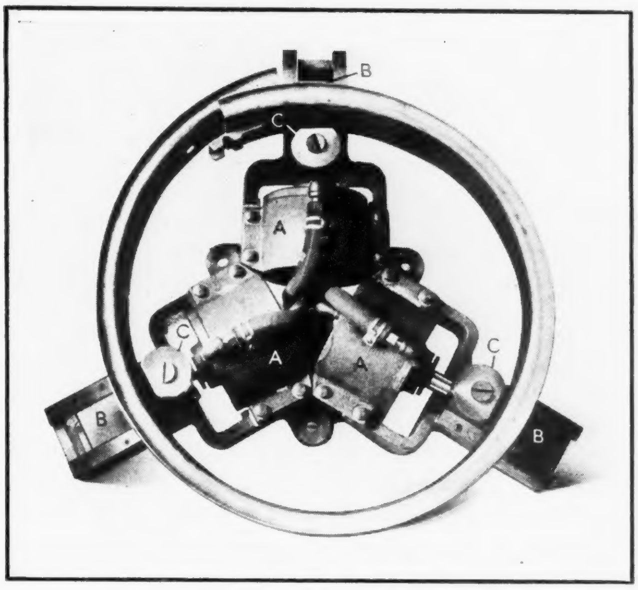


Fig. 5. Fixture Designed to Facilitate the Assembly of Automobile Tires on Rims

The slots in one end of the tubes are staggered relative to the slots in the other end, and so it was necessary to provide a means of properly locating the tubes when they are reversed in bushings *A*. This is effected by a spring pin in these bushings, which merely rides on top of the tube in the first operation, but which is entered into one of the milled slots when the tube is reversed in the bushing.

Fig. 7 shows an indexing fixture designed to permit four tubular pieces to be bored while four others are being loaded. At the end of each operation, the fixture is indexed to carry the finished pieces away from beneath the machine spindles and bring the new pieces in alignment with the spindles. The chuck jaws in each of the eight units are of standard design and grip the outside of the tubes.

There is a piston and a cylinder for operating each set of jaws. Each piston *A* operates through a piston-rod *B* to open and close the corresponding chuck jaws. The piston-rods are hollow to permit chips and cutting

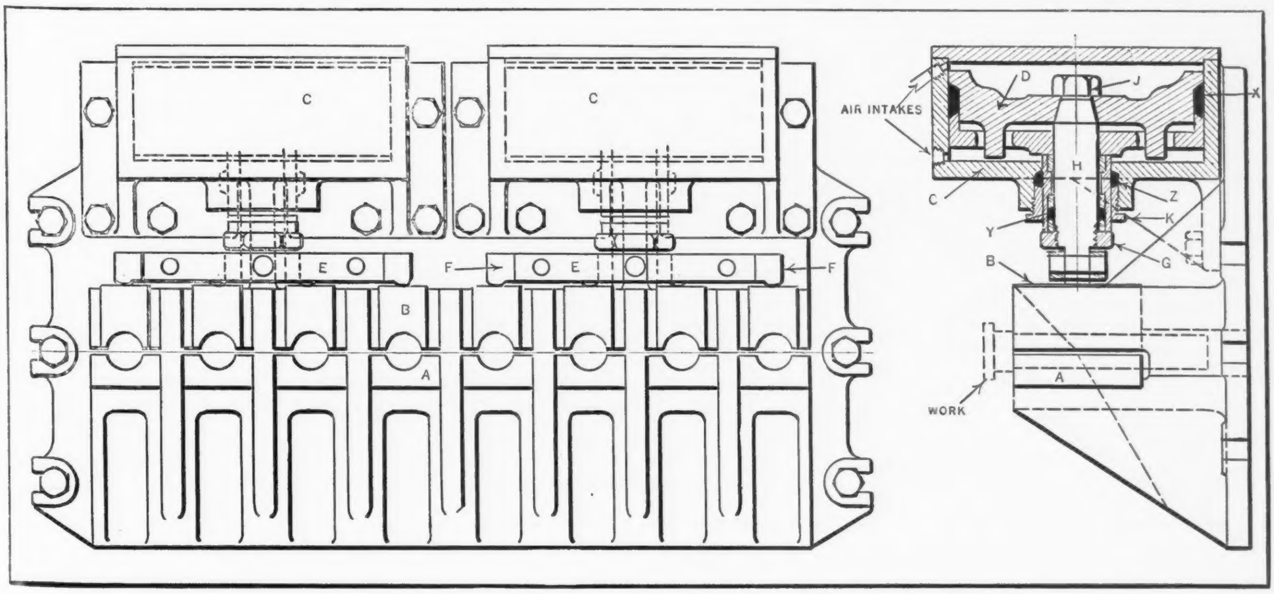


Fig. 6. Two-cylinder Jig Employed in Simultaneously Drilling Eight Bolts

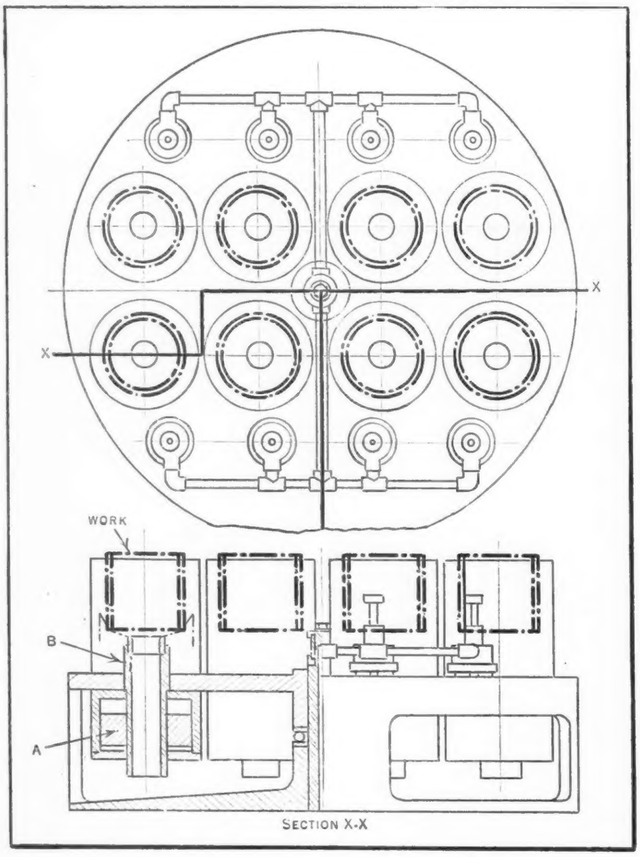


Fig. 7. Indexing Fixture Used in a Boring Operation

lubricant to escape. Air is delivered to the fixture through a central connection which is also of swivel type to permit indexing.

Tire Assembling Fixture

Various devices are employed in automobile plants for contracting steel tire rims in order to facilitate the assembly of the tires. Fig. 5 shows an air-operated equipment developed for this purpose. It will be seen that there are three separate units which are operated by cylinders *A*, these cylinders moving slides *B*. On each of these slides are mounted a cam *C* and a small collar which comes in contact with the outside of the rim.

When air is admitted simultaneously into all three cylinders to draw slides *B* toward the center of the fixture, the collars on these slides contract the rim enough to permit slipping the tire into place. Then cams *C* are swiveled on their posts to bring the large sides toward the rim, after which air is applied on the inner sides of the pistons to force the slides and the rim outward. The rim is kept expanded until the ends have been locked together. After this fixture was put into use, it was found unnecessary to swivel two of the cams, and so these two cams were replaced by plain collars.

Chucks for Automobile Rear-axle Housing

Chucks designed for holding an automobile rear-axle housing while rough- and finish-facing and boring cuts are being taken are illustrated in Figs. 8 and 9. For the first operation, in which flange surface *X* and a bearing of the housing are faced and the bearing is bored, the housing is held as shown in Fig. 8. The periphery of the flange is gripped by tool-steel inserts *A* of three jaws *B*, and the shank of the housing is held in alignment with the machine spindle by means of a collar *C* which is slipped over the shank before the housing is placed in the machine. This collar is entered into sleeve *D*.

This operation has two distinct steps, in the first of which roughing cuts are taken, and in the second, finishing cuts on the same surfaces. To insure against distortion of the flange, an air pressure of only 8 pounds per square inch is used in the second step, while a pressure of 70 pounds per square inch is employed in the first step. The two pressures are obtained through a regulating valve.

When air is admitted into the cylinder to grip the work, sleeve *D*, which is connected to the piston-rod, is pulled toward the left. This movement causes three bellcrank levers *E* to swivel and pull jaws *B* and their inserts *A* toward the work. The housing is driven by three lugs which are engaged by the jaws.

When the air pressure is released in the cylinder, six springs *F* exert sufficient pressure on sleeve *D* and the remainder of the chuck mechanism to just release the housing. Air at a pressure of 8 pounds per square inch is then admitted into the cylinder to grip the work for the final step. The tension of springs *F* is adjustable. Bushing *G* receives a pilot of the boring and facing bar. Inserts *A* are reversible, so that either of two knife-edges of the proper

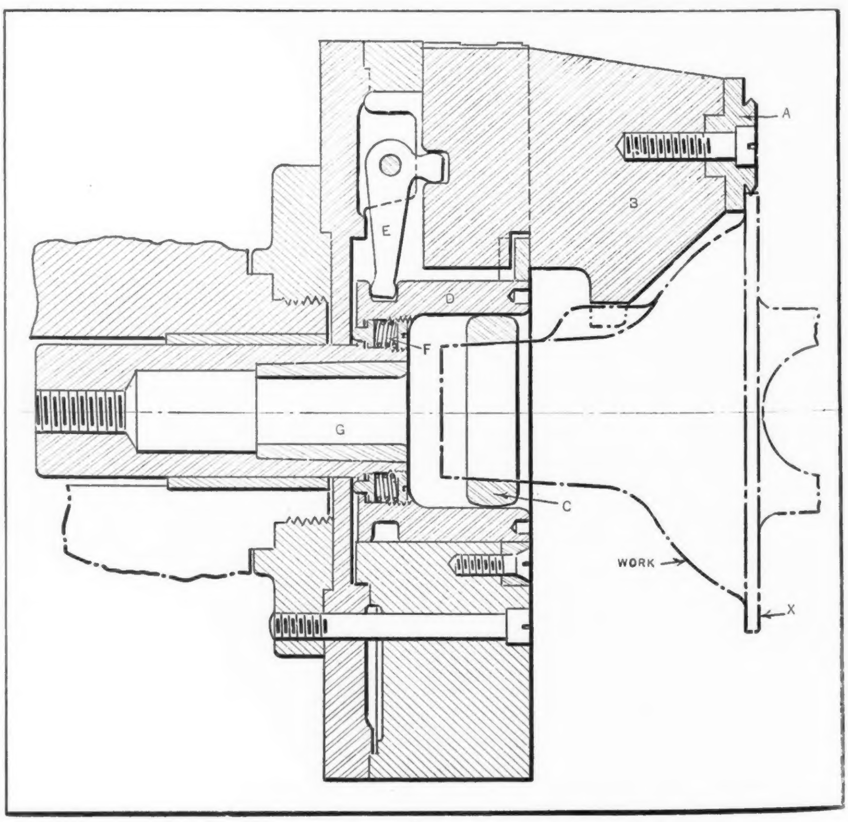


Fig. 8. Chuck Used in Machining an Automobile Rear-axle Housing

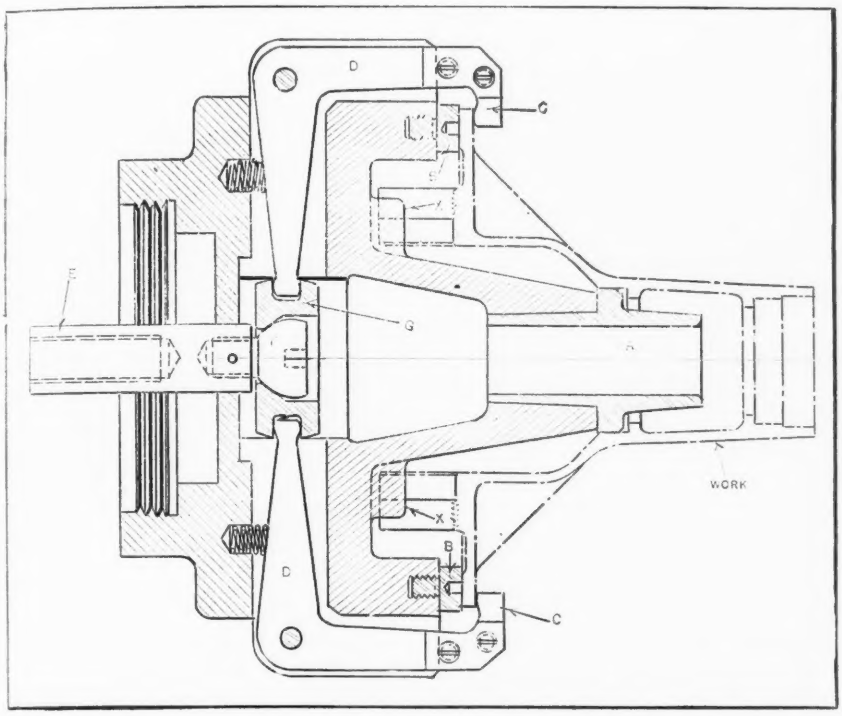


Fig. 9. Chuck Employed for Holding the Rear-axle Housing in the Second Operation

contour can be brought into contact with the flange periphery.

Several boring and facing cuts are taken on the shank of the housing in the second operation. The housing is accurately held for this operation by slipping the bearing that has previously been finish-bored over the ground flange of bushing *A*, Fig. 9, and by seating the finished flange face of the housing against four hardened and ground buttons *B*. Inserts *C* on jaws *D* hold the flange face against the buttons. The hole in bushing *A* is ground and used to guide the boring-bar.

Inserts *C* are pulled against the housing flange when air is admitted into the cylinder to pull the piston-rod connection *E*, ball plug *F*, and socket *G* toward the left. This movement causes the bell-crank levers *D* to swing their outer ends toward the work. The ball and socket construction of members *F* and *G* compensates for variations in thickness of the housing flanges. In this operation, the work is rotated by lugs *X* on the chuck body coming in contact with projections on the housing.

Drill Jig for Multiple-spindle Machine

A blind hole is drilled in the head end of eight shoulder bolts by means of the fixture shown in Fig. 6. Each of these bolts is gripped between a stationary jaw *A* and a movable jaw *B*. The shoulder of the bolts rests on top of these jaws. When air is admitted into cylinders *C* in back of pistons *D* to force the pistons forward, each bar *E* presses two equalizing members *F* against four of the movable jaws to clamp the eight bolts. Only a 1/4-inch stroke of pistons *D* is required for clamping or unclamping the bolts.

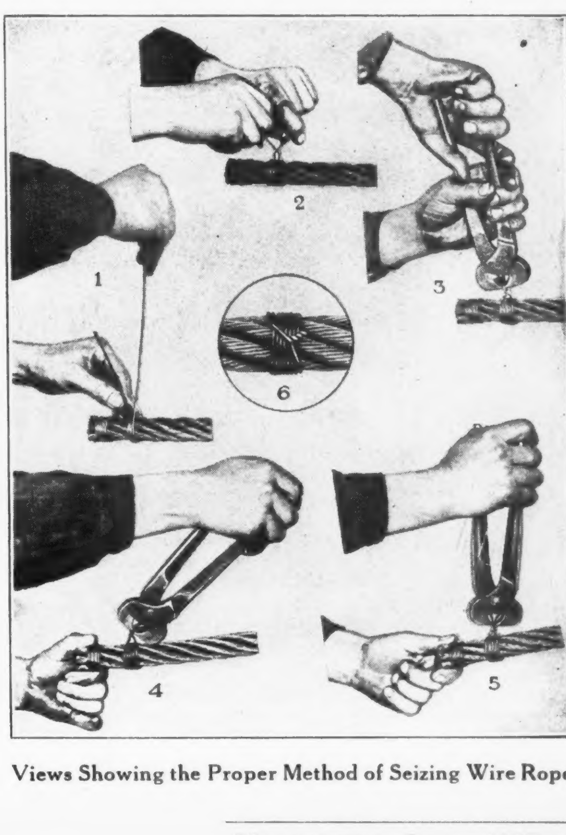
A feature of this jig is the means provided for adjusting the packing. To tighten packing *X*, it is merely necessary to advance nut *G* on piston-rod *H*, to decrease the distance between nuts *G* and *J*. This adjustment of nut *G* also tightens packing *Y*. Gland *K* is adjusted to tighten packing *Z*.

HOW TO SEIZE WIRE ROPE

The end of an ordinary wire rope should have at least three seizings to prevent unlaying, which, if it occurs, would render the rope useless. The seizings may be replaced by fittings if they are designed to prevent unlaying of the rope. The procedure recommended by the American Cable Co. is as follows:

1. Wind the seizing wire on the rope by hand, keeping the coil together and considerable tension on the wire, winding over from left to right, as in Fig. 1 of the accompanying illustration.
2. Twist the ends of the wire together counter-clockwise by hand so that the twisted portion of the wires is near the middle of the seizing (Fig. 2).
3. Tighten the twist, by using pliers, just enough to take up the slack, as shown in Fig. 3. Do not try to tighten the seizing by twisting.
4. Tighten the seizing by prying the twist away from the axis of the rope in the manner illustrated in Fig. 4.
5. Tighten the twist again as in (3). Repeat (4) and (5) as often as is necessary to make the seizing tight and rigid. Cut off the ends of the wires, and pound the twist flat against the rope. The appearance of the finished seizing is shown in Fig. 6.

Any annealed low-carbon steel wire may be used for seizings, the size ranging from No. 10 to No. 18, depending upon the diameter of the rope. This method is taken from the United States Government Master Specifications No. 297.



Views Showing the Proper Method of Seizing Wire Rope

MACHINING HUGE CASTINGS AND FORGINGS

The building of two 94,000-kilowatt tandem-compound turbine-generators at the plant of the General Electric Co. for the Southern California Edison Co. involves the machining of some exceptionally heavy castings and forgings. The main generators, it is stated, exceed in both capacity and physical dimensions any electric generator previously built, and the turbines are also the largest of the tandem-compound type so far constructed.

Each turbine-generator will measure 103 feet in length and will weigh about 1,650,000 pounds. Other unusual features of these machines include provision for future gas-cooling of the generators, and the combination of a double-flow low-pressure end with four vertical condensers. They will be the first of their type to generate current at 16,500 volts.

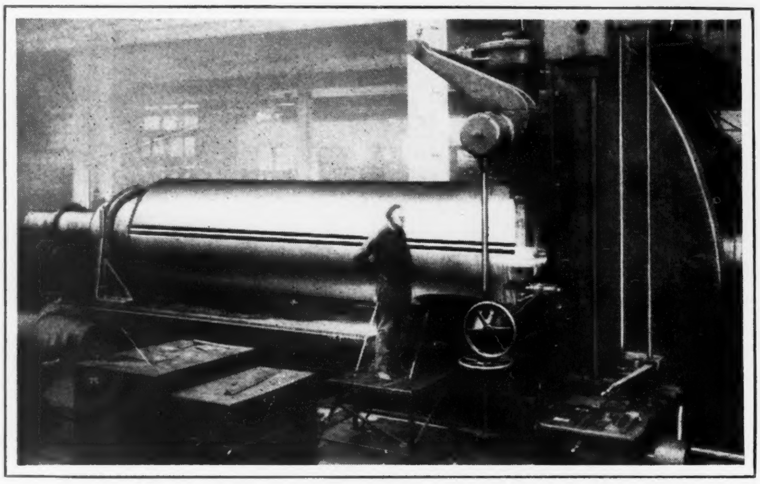


Fig. 1. Slotting Field of Large Generator

In Fig. 1 is shown the field of the generator, undergoing the slotting operation. Two cuts are taken at the same time, on opposite sides of the shaft. The time required to complete one cut is eight hours. This field, which is said to be the largest ever made, weighs 208,000 pounds complete. In Fig. 2 is shown the high-pressure shell of the high-pressure element of the turbine. This shell is of one piece, stands slightly over 10 feet high on the boring mill table, and weighs 82,000 pounds. In Fig. 3 is shown the entire low-pressure hood of the high-pressure element of the turbine. This consists of two parts, having a height of 24 feet 7 1/2 inches and weighing 70,600 pounds.

* * *

The American Foundrymen's Association has decided to make a comprehensive study of cast iron, beginning this study by preparing a complete bibliography of the existing literature on the subject. All articles of special value will then be selected, and the information obtained from each summarized, classifying the information under various sub-divisions. From this summary, the committee expects to formulate a research program to furnish information on subjects that have not been adequately investigated in the past.

In addition to the mentioned activity, the committee is endeavoring to complete arrangements for an immediate investigation of the effects of the use of borings and turnings in blast furnaces on the quality of pig iron. The need of this investigation has been recently emphasized by the publication of divergent views.

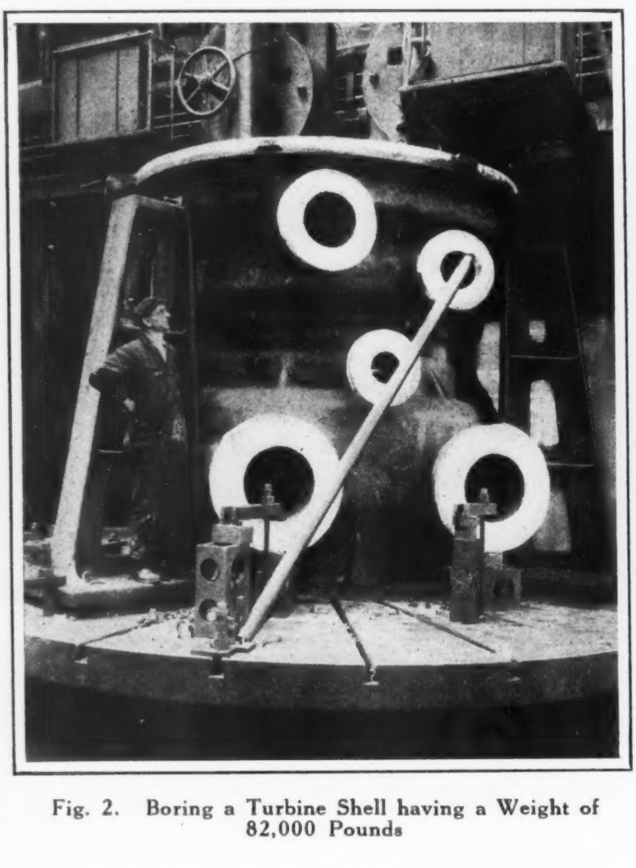


Fig. 2. Boring a Turbine Shell having a Weight of 82,000 Pounds

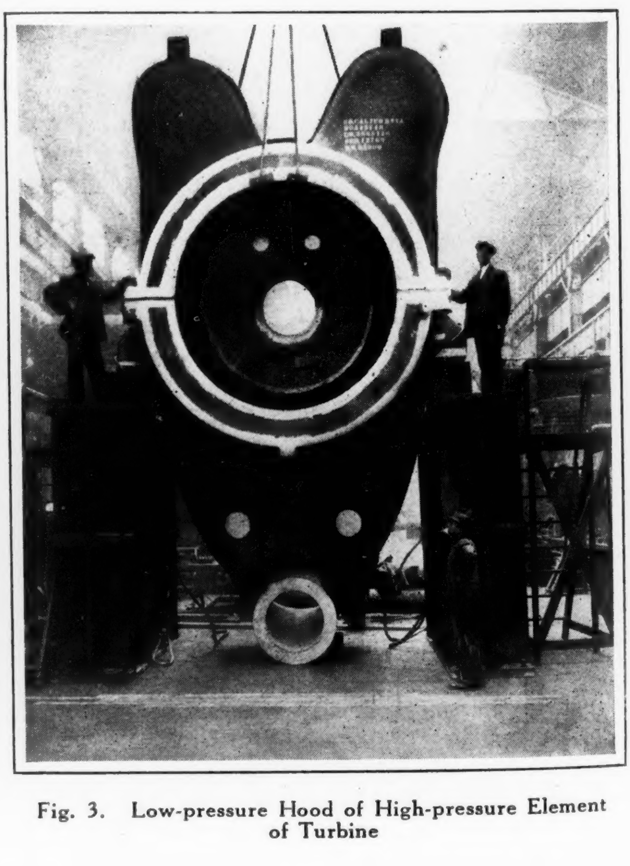
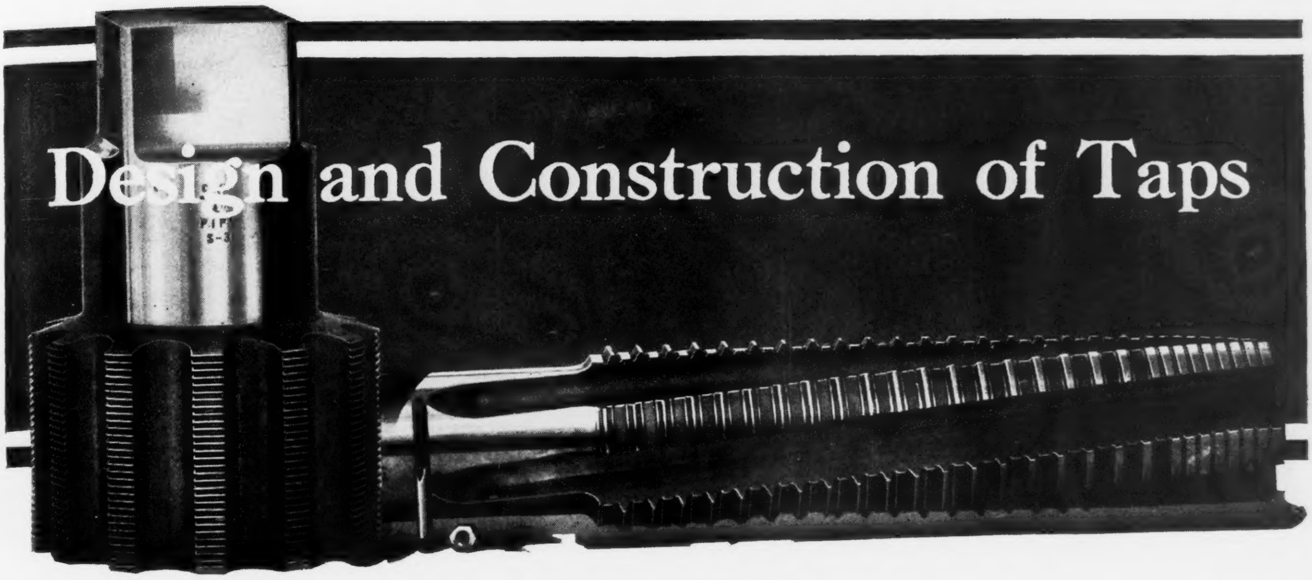


Fig. 3. Low-pressure Hood of High-pressure Element of Turbine

Design and Construction of Taps



With Special Reference to Taps Having Ground Threads—Third of a Series of Articles

By A. L. VALENTINE, Manager, Tap and Gage Division, S K F Industries, Gothenburg, Sweden

IN the first article of this series, published in April MACHINERY, inaccuracies frequently found in taps that are not ground in the thread after hardening were discussed. In the second installment, the reasons for the development of the ground tap, tolerances, and other important considerations in the design and construction of taps were dealt with. The present article will take up mainly the subject of flutes in taps.

Advantages and Disadvantages of Spiral Flutes

Spiral flutes in taps are generally milled so that the spiral angle of the flute is at right angles to the helix angle of the thread, as shown in the examples indicated in Fig. 1. The result is that both sides of the thread angle cut simultaneously; this reduces the power required for tapping, produces a correct thread form in the hole, and gives to both of the angular sides of the thread the same smooth finish, which is never the case in holes tapped with straight-fluted taps, whether ground or unground.

When holes are tapped with spiral-fluted taps, the chips have a tendency to feed into the hole ahead of the tap. This helps to prevent clogging of the chips in the flutes and minimizes tap breakage. In taps where the spiral angle relative to the center line of the tap is small, this advantage is of no great practical value, because it is more of a tendency than an accomplished fact. It might be thought that taps to be used for tapping bottoming holes should not be provided with spiral flutes because of the tendency of the chips to feed ahead of the tap and to clog in the bottom of the hole, but the other advantages gained through the use of spiral flutes outweigh any such disadvantage. Generally speaking, in tapping bottoming holes, particularly in a vertical machine, both straight- and spiral-fluted taps may give trouble from the cause mentioned, the best type of flute in that case being one that has a quick spiral in the opposite direction, as in a twist drill.

The Forms of Flutes in Taps

Ordinary taps of all types, ground or unground, are generally made with an even number of flutes, in order to facilitate manufacture, measuring, and inspection. Nut taps are the only regular taps that can be made to advantage with an odd number of

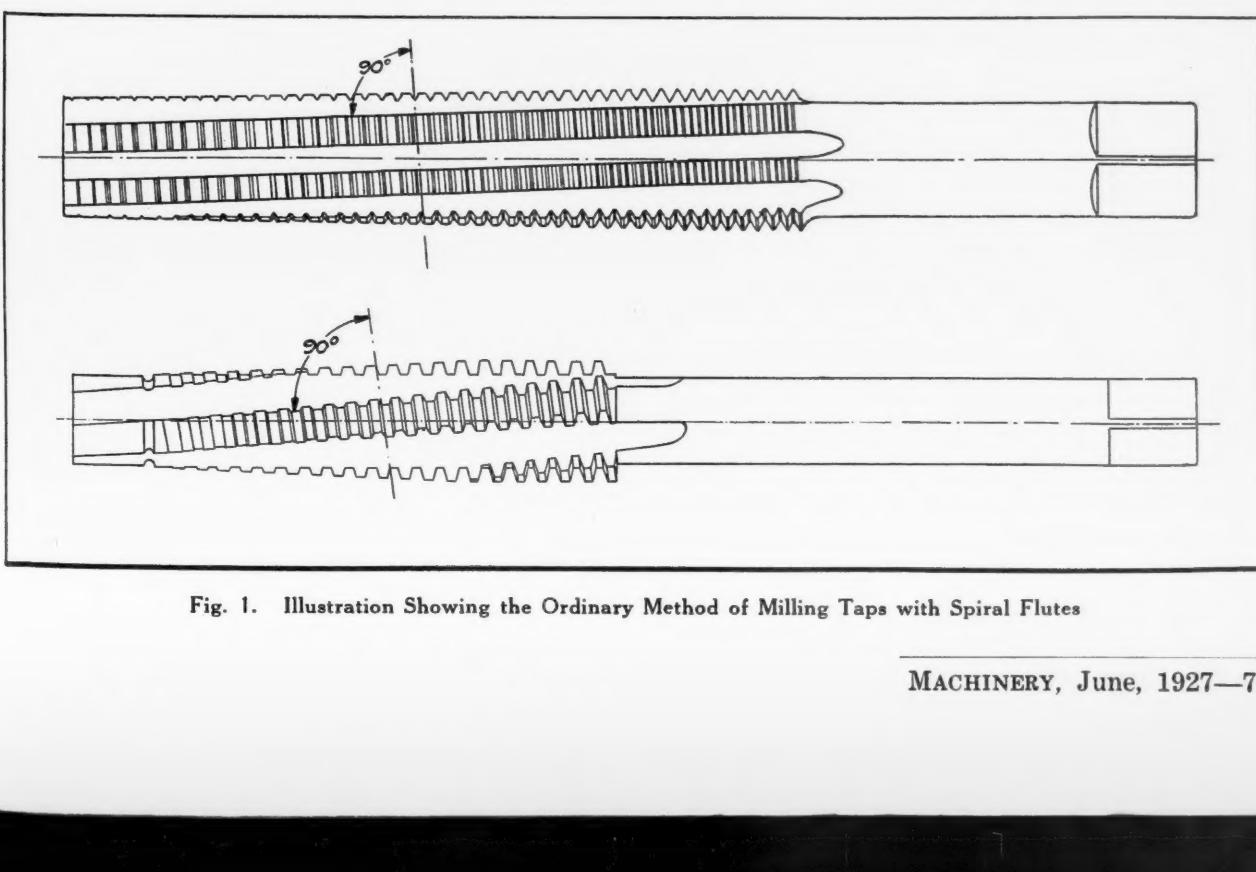


Fig. 1. Illustration Showing the Ordinary Method of Milling Taps with Spiral Flutes

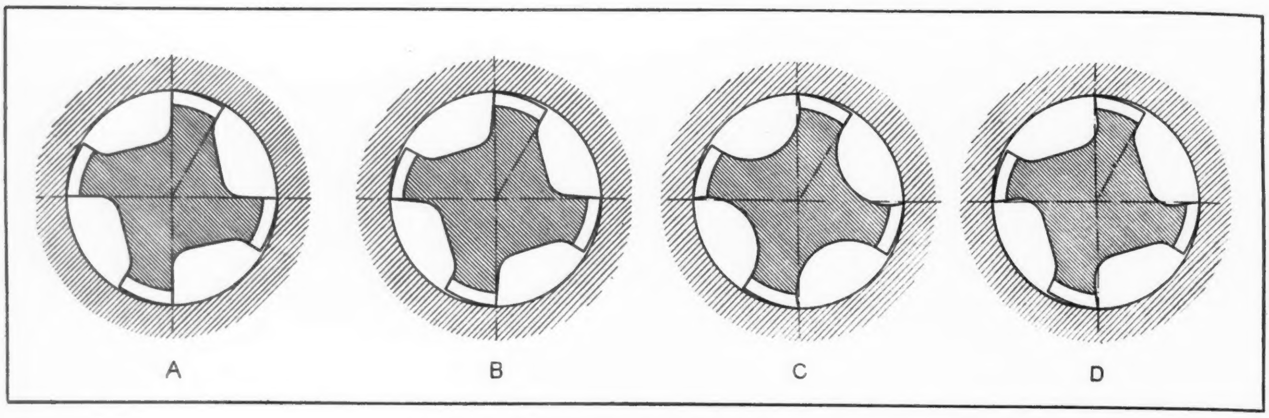


Fig. 2. Different Methods of Fluting Taps

flutes. One of the most important points in the construction of taps is the form of the flutes. The most important of the considerations in this connection are as follows:

1. The flute should be so constructed that real chips are cut when the tap is threading a hole.

2. The flutes must be shaped according to the material for which the tap is to be used; for some materials the cutting edge should have a positive rake, and for others, negative; for some, it should have a curved shape while for others it should be radial. In Fig. 2 are shown four different forms of flutes. *A* shows one with a radial cutting edge; *B*, one with negative rake; *C*, one with a curved cutting edge; and *D*, one with constant positive rake. The purposes for which each of these taps are best suited are as follows: *A*, for general use, but not particularly recommended; *B*, for brass and similar materials; *C*, for very tough materials, hot-rolled steel, etc.; *D*, for steel, bronze, and general use.

3. The flute form must be such that when the tap is backed out, the chips will not clog at the back of the lands and force themselves in between the threads in the hole and the relieved teeth of the tap. If that happens, the hole will be spoiled and the tap, or some of its teeth, broken.

4. The flute form must be such that the lands will be strong enough not to break when the tap is in use, and at the same time, the flute must be deep enough so that the chips will not clog.

The form of the cutting edge and the form of the flute, as a whole, are subjects that have been frequently discussed in the technical press. However, new developments and discoveries are constantly being made, and Figs. 3 to 7, and the accompanying tables, contain what the writer believes to be the latest developments in this field.

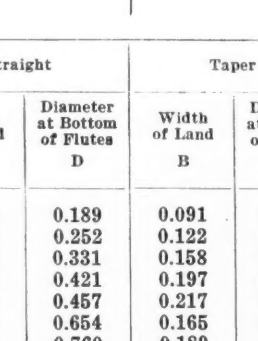
Fig. 3 shows a tap milled with a convex cutter. The radius and depth of the flute *R* is equal to 1/4 of the diameter of the tap for a four-fluted tap. The width of the land is somewhat greater than half of the width of the flute in four-fluted taps. The line drawn in full at the back of the land shows a modified form of flute in which the back of the land is radial for a distance equal to 1 1/4 times the depth of the thread.

In the example shown, the rake of the cutting edge is positive for 84 per cent of the depth of the thread, and negative for the remainder of the distance near the bottom of the thread. The angle of rake is equal to 14 1/2 degrees at the outside diameter and 5 1/4 degrees at the pitch diameter; there is a negative rake of 3 degrees at the bottom diameter.

In Fig. 4 is shown a comparison between flutes produced by a convex cutter and by one of modified form. Here the flute is milled to a somewhat greater depth than shown in Fig. 3, so that the cutting edge has a positive rake for the full depth of the thread. The width of the land is made as described in connection with Fig. 3, and the back of the land is radial for the same depth as described in the previous paragraph. The positive rake of the cutting edge is 16 3/4 degrees at the outside diameter, 8 1/2 degrees at the pitch diameter, and 0 at the root diameter.

In Fig. 5 is shown a flute produced with a special fluting cutter. Here the same cutting angle or rake is produced as in Fig. 4. The width

Width of Land and Depth of Flute on Pipe Taps



Nominal Pipe Diameter	Straight		Taper		Number of Flutes
	Width of Land B	Diameter at Bottom of Flutes D	Width of Land B	Diameter at Bottom of Flutes D	
1/8	0.098	0.189	0.091	0.161	4
1/4	0.134	0.252	0.122	0.232	4
3/8	0.169	0.331	0.158	0.291	4
1/2	0.213	0.421	0.197	0.370	4
5/8	0.232	0.457	0.217	0.406	4
3/4	0.181	0.654	0.165	0.598	6
7/8	0.209	0.760	0.189	0.701	6
1	0.228	0.819	0.217	0.748	6
1 1/4	0.287	1.067	0.272	0.992	6
1 1/2	0.327	1.224	0.315	1.146	6
1 3/4	0.366	1.394	0.354	1.315	6
2	0.307	1.685	0.295	1.606	8
2 1/4	0.339	1.882	0.327	1.787	8
2 1/2	0.386	2.165	0.374	2.087	8
2 3/4	0.425	2.362	0.413	2.264	8
3	0.362	2.693	0.350	2.614	10
3 1/4	0.386	2.882	0.370	2.783	10
3 1/2	0.413	3.083	0.398	3.004	10
3 3/4	0.441	3.291	0.429	3.173	10
4	0.386	3.622	0.378	3.504	12

Machinery

of the land is 1/2 the width of the flute, and the greatest depth of the flute is the same as in Fig. 3.

In Fig. 6 we have again a flute milled with a special fluting cutter. Here we have a 5-degree positive rake of the cutting edge for a depth equal to 1 1/2 the depth of the thread; the width of the land is somewhat greater than half of the width of the flute; the back of the land is radial, as in Fig. 1; and the depth of the flute is approximately 2/7 times the diameter of the tap.

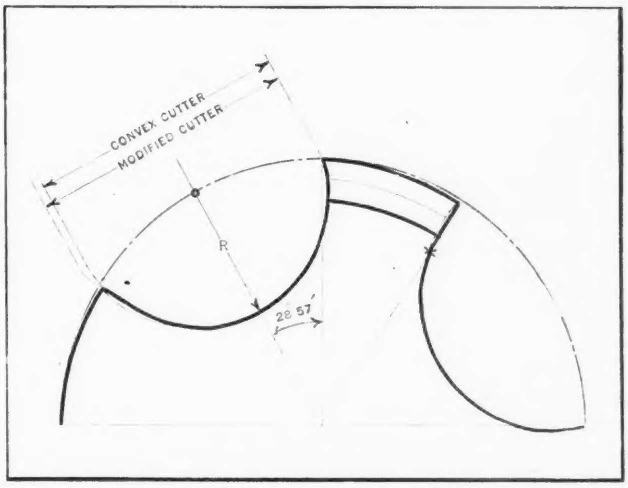


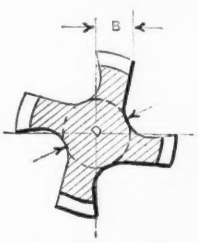
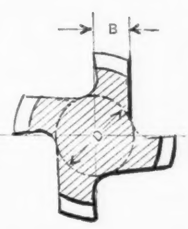
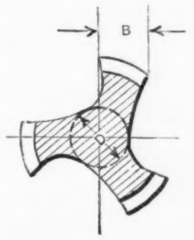
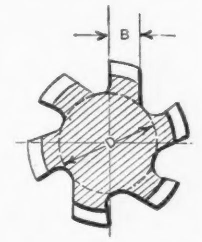
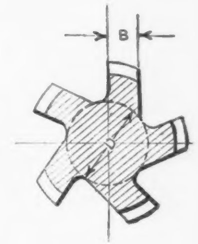
Fig. 3. Tap with Four Flutes Milled with a Convex or Slightly Modified Convex Cutter

In Fig. 7, a flute milled with a special fluting cutter, producing an 8 1/2-degree positive rake at the cutting edge, is shown. The radial distance both in front and back of the land is 1 1/4 times the depth of the thread; the width of the land is slightly greater than half the width of the flute; and the depth of the flute is the same as in Fig. 6. The form of flute shown in Fig. 7 is not recommended.

Important Points Relating to the Shape of Flutes

The back face of the lands must, at least, be radial in order to prevent chips from becoming wedged between the relieved teeth of the tap and the threads in the hole when the tap is backed out. A curved form on the back of the lands would be still better, if nothing else had to be taken into consideration than to prevent chips getting wedged in when backing out the tap; but as may be seen from Fig. 4, this would not only weaken the section of a tap land, but also might cause it to scrape and cut when the tap was backed out; hence, a curved contour at the back of the land is not recommended.

Width of Land and Depth of Flute on Taps

Nominal Diameter of Tap, Inches	Taps for Tapping Through as well as Bottoming Holes (Hand Taps, etc.)			Taps for Tapping Through Holes Only. (Machine and Tapper Taps) Even Number of Flutes			Taps for Tapping Through Holes Only. (Machine and Tapper Taps) Odd Number of Flutes			Die Hobs for Threading Die Chasers. (Chasers Mounted in Master Head While Being Threaded)			Die Hobs for Threading Dies		
															
	Standard Hand Taps			Nut and Tapper Taps			Nut and Tapper Taps			Die Hobs			Die Hobs		
	Width of Land B	Diameter at Bottom of Flutes D	Number of Flutes	Width of Land B	Diameter at Bottom of Flutes D	Number of Flutes	Width of Land B	Diameter at Bottom of Flutes D	Number of Flutes	Width of Land B	Diameter at Bottom of Flutes D	Number of Flutes	Width of Land B	Diameter at Bottom of Flutes D	Number of Flutes
1/4	0.063	0.106	4	0.059	0.114	4	0.083	0.079	3	0.075	0.138	5	0.055	0.138	5
5/16	0.083	0.134	4	0.079	0.147	4	0.110	0.102	3	0.095	0.173	5	0.071	0.173	5
3/8	0.099	0.165	4	0.091	0.84	4	0.118	0.118	3	0.095	0.224	6	0.083	0.205	5
7/16	0.114	0.193	4	0.116	0.221	4	0.154	0.152	3	0.110	0.260	6	0.095	0.240	5
1/2	0.134	0.217	4	0.130	0.249	4	0.173	0.165	3	0.126	0.299	6	0.110	0.276	5
5/8	0.161	0.287	4	0.146	0.308	4	0.232	0.220	3	0.158	0.394	6	0.138	0.362	5
3/4	0.193	0.366	4	0.213	0.394	4	0.260	0.252	3	0.189	0.472	6	0.165	0.433	5
7/8	0.228	0.413	4	0.236	0.454	4	0.303	0.315	3	0.221	0.551	6	0.193	0.508	5
1	0.260	0.472	4	0.268	0.508	4	0.350	0.394	3	0.252	0.630	6	0.221	0.579	5
1 1/8	0.291	0.532	4	0.299	0.524	4	0.390	0.433	3	0.280	0.709	6	0.248	0.650	5
1 1/4	0.323	0.602	4	0.331	0.650	4	0.433	0.512	3	0.248	0.850	8	0.276	0.748	5
1 3/8	0.354	0.650	4	0.362	0.716	4	0.480	0.551	3	0.276	0.933	8	0.303	0.823	5
1 1/2	0.391	0.724	4	0.386	0.732	4	0.524	0.591	3	0.299	1.020	8	0.335	0.906	5
1 5/8	0.421	0.760	4	0.409	0.787	4	0.567	0.650	3	.....	.....	..	.....	.....	..
1 3/4	0.453	0.843	4	0.461	0.905	4	0.610	0.709	3	.....	.....	..	.....	.....	..
1 7/8	0.327	1.035	6	0.335	1.071	6	0.386	0.980	5	.....	.....	..	.....	.....	..
2	0.346	1.157	6	0.366	1.201	6	0.421	1.102	5	.....	.....	..	.....	.....	..
2 1/4	0.390	1.307	6	0.370	1.339	6	.....	.....	..	.....	.....	..	.....	.....	..
2 1/2	0.433	1.468	6	0.437	1.496	6	.....	.....	..	.....	.....	..	.....	.....	..
2 3/4	0.476	1.622	6	0.488	1.685	6	.....	.....	..	.....	.....	..	.....	.....	..
3	0.445	1.961	8	0.406	1.929	8	.....	.....	..	.....	.....	..	.....	.....	..
3 1/4	0.480	2.134	8	0.441	2.047	8	.....	.....	..	.....	.....	..	.....	.....	..
3 1/2	0.520	2.323	8	0.465	2.205	8	.....	.....	..	.....	.....	..	.....	.....	..
3 3/4	0.555	2.480	8	0.504	2.362	8	.....	.....	..	.....	.....	..	.....	.....	..
4	0.591	2.677	8	0.539	2.480	8	.....	.....	..	.....	.....	..	.....	.....	..

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The most important part of the flute form, however, is the shape of the cutting part in front of the lands. The flute form shown in Fig. 3 is one of the most commonly used forms of flute in taps. The great drawback to this form is that the cutting edge does not have a constant rake but a variable one—positive at the outside diameter and negative near the bottom of the thread. This difficulty is partially avoided in Fig. 4, where the tap is fluted to such a depth that the rake is positive (but not uniform) for the whole depth of the thread. Fluting a tap to this depth, however, makes the lands too weak, unless the form of the convex cutter is modified as indicated by the full line on the back of the tap lands.

The form of flute shown in Fig. 5 is recommended for taps for through holes, such as tapper taps and nut taps. Taps of this type are often used by unskilled help and subjected to more severe duty than hand taps. However, they are not backed out of the hole, so that the shape of the flute at the back of the land is of little importance, so long as the lands are strong enough to withstand the severe duty of the tap.

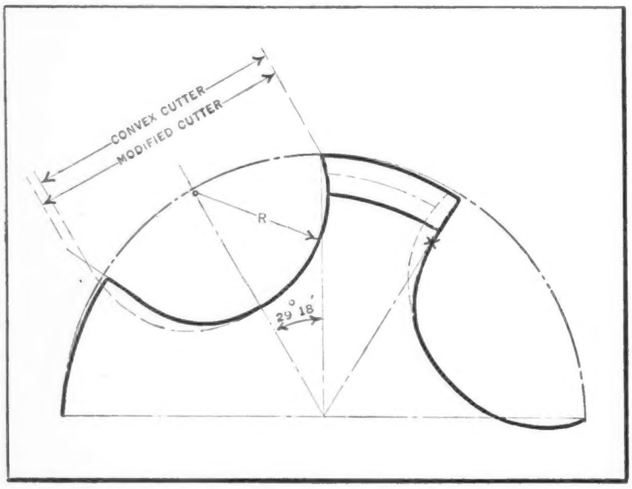


Fig. 4. Tap with Four Flutes Milled with a Modified Convex Cutter—Recommended for Hand Taps

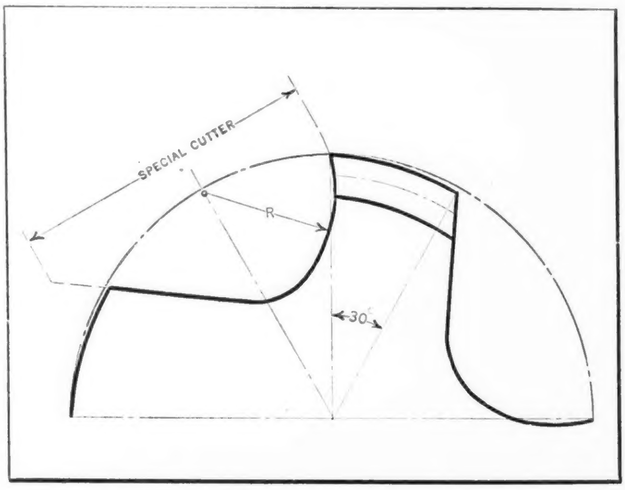


Fig. 5. Recommended Shape of Flute for Machine and Tapper Taps

The forms shown in Figs. 6 and 7, where there is a constant positive rake on the tap, have proved far superior to the form shown in Fig. 3. Furthermore, inasmuch as the rake is constant for the whole depth of the thread, it can easily be varied to suit different kinds of metal to be tapped. For actual ease in cutting, however, tests have proved that these taps are inferior to taps fluted as shown in Figs. 4 and 5, and generally speaking, the writer would recommend the flutes in Fig. 4 for taps that have to be backed out of holes, and the flutes shown in Fig. 5 for taps that need not be backed out.

In tests made, these taps have proved quite as long-lived and have tapped as many holes between sharpenings as any others. It may be pointed out that taps with flutes such as shown in Figs. 4 and 5 are somewhat more difficult to sharpen, because it is not so easy to maintain the correct flute shape as when the cutting edge is straight. This difficulty, however, is small compared with the advantages gained. Tables giving width of land and depth of flutes accompany this article.

A number of tests have been conducted by the S K F Ball Bearing Co. at Gothenburg, Sweden, for the purpose of determining the relative merits of taps with three and four flutes, with straight and spiral flutes, and with regular threads and interrupted threads (that is, with every other thread cut away).

In these tests, six one-half inch Whitworth machine nut taps were used, one having four straight flutes; one, four spiral flutes; one, three straight flutes; one, three spiral flutes; one, three straight flutes with interrupted thread; and one, three spiral flutes with interrupted thread. The taps were used alternately, tapping ten nuts with each in succession until nearly 8000 nuts had been tapped with each tap without sharpening. This procedure was followed in order to obtain a correct comparison, irrespective of variations in the nut material.

Results of Tests on Taps with Different Types of Flutes

The results of the tests prove:

1. That three-fluted taps have a decidedly lower cutting resistance than those with four flutes, and that three-fluted taps are much better from this point of view.

2. That the wear on four-fluted taps is decidedly less than on three-fluted taps, depending upon the smaller chip thickness for the tap with four flutes. After 6000 nuts had been tapped, the threads in the nuts produced with the three-fluted taps were somewhat inferior to those produced with the four-fluted taps.

3. That taps with straight and spiral flutes have approximately the same tapping resistance—somewhat less, however, for taps with spiral flutes. Hence, taps with spiral flutes have no decided advantage over taps with straight flutes, except on taps with coarse leads and great depth of thread, as previously mentioned in these articles. The character of the thread in the nut was about the same for taps with straight and spiral flutes—somewhat better, however, on those produced with spiral-fluted taps.

4. That taps with interrupted threads have about the same tapping resistance as those with regular threads—somewhat greater, however, for the interrupted thread. Taps with interrupted threads did not cut so evenly and smoothly as those with

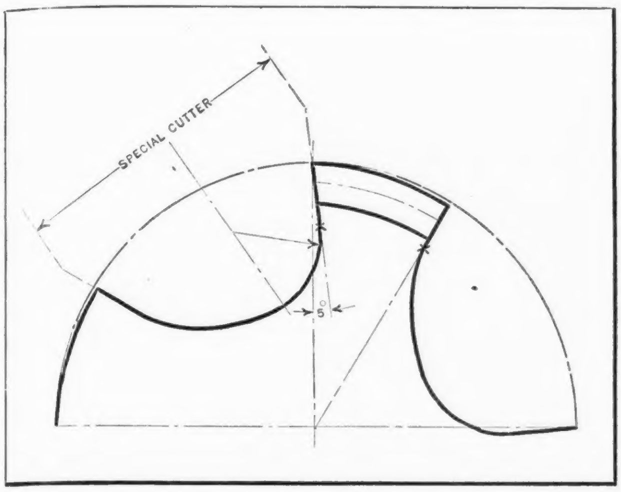


Fig. 6. Tap with Four Flutes Milled with Special Cutter Producing 5-degree Constant, Positive Rake on the Cutting Edges

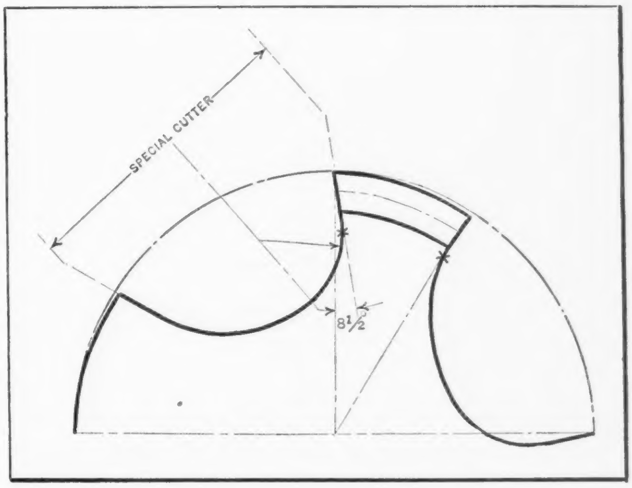


Fig. 7. Tap with Four Flutes Milled with Special Cutter Producing 8 1/2-degree Constant, Positive Rake on the Cutting Edges

regular threads, and where the former had been dulled to a great extent, they showed a tendency to produce uneven and somewhat torn threads, whereas the taps with regular threads, when equally dulled, did not give rise to these difficulties.

Chip Room in Ground and Unground Taps

In discussing flute depth and flute form, the author wishes to point out the curious fact that ground taps have, in effect, more chip room than those that are finish-threaded before hardening, although the flute form and the flute depth may be identical in both taps. This is due to the fact that in a ground tap, each tooth does its proportional share of the work, and the amount of chips will be the same in every flute; but unground taps, no matter how carefully straightened, are never absolutely straight, and as a result, some teeth cut more than others, so that some of the flutes are called upon to carry more than their share of the chips—sometimes sufficient to clog them. This, as well as the fact that some of the teeth perform a great deal more than their share of the work, tends to spoil or break the tap.

SPECIAL PISTON-HEAD CHUCK

By E. A. MURRAY, Shop Superintendent, The Chesapeake and Ohio Railway Co.

A special piston-head chuck is being used at the Huntington Shops of the Chesapeake and Ohio Railway Co. which provides clearance for the tools of a vertical turret lathe or boring mill so that the entire circumference of the head can be turned at one setting. Fig. 1 shows a piston-head in position, and Fig. 2 the arrangement of the chuck.

The usual cored holes are tapped, and three studs *A* which are part of the chuck equipment are screwed into these holes. Two of these studs enter holes *B* in the chuck, and the third stud enters hole *C*. The latter is in a separate movable section *E* of the chuck plate, so that when clamping bolts *D* are tightened, studs *A* are securely gripped in the three holes, as section *E* is forced toward the fixed part *F*. This movable section of the chuck plate has two coil springs which hold it outward against the heads of the clamping bolts. There are also two guides *G* attached to the movable plate, which hold the two parts in proper alignment.

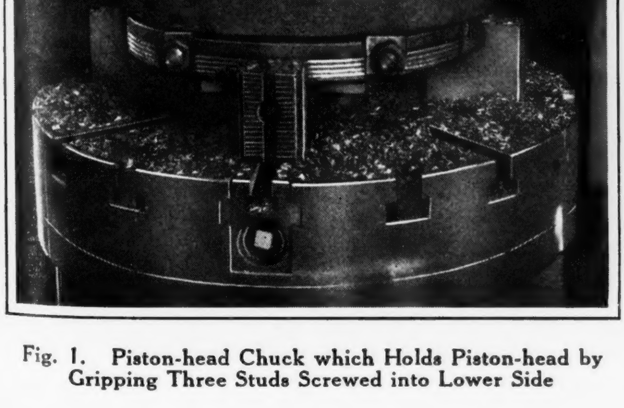


Fig. 1. Piston-head Chuck which Holds Piston-head by Gripping Three Studs Screwed into Lower Side

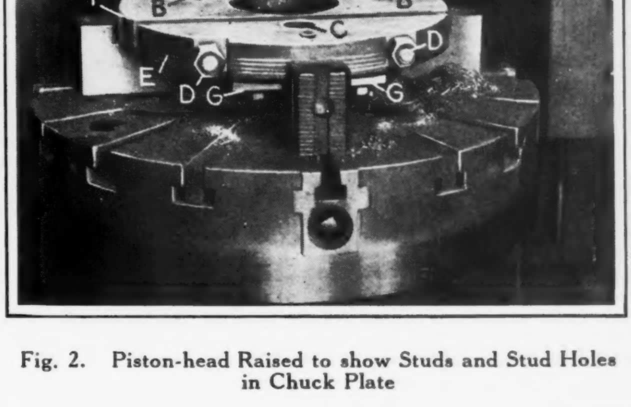


Fig. 2. Piston-head Raised to show Studs and Stud Holes in Chuck Plate

Notes and Comment on Engineering Topics

Should the mercury boiler become a generally used successful means for producing power, the demand for mercury will increase to a very great extent. The largest and richest known deposits of mercury in the world are located in central Spain; there are also deposits in the western part of the United States. The Spanish deposits have been mined almost continuously since the early Roman Empire, and have been owned and worked by the Spanish Government since 1645. The mines are now worked to a depth of more than 2000 feet, and the available reserve of mercury is estimated to be at least 40,000 tons of metal.

The exacting demands placed by the oil industry upon the mechanical industry that supplies the tools and equipment for the drilling of oil wells is not generally appreciated until one has seen an oil well being drilled. The deepest well ever drilled is the Olinda No. 96, in California, which has reached a depth of over 8000 feet, or over a mile and a half. Terrific strains are placed on the drilling equipment in drilling at such great depths. On its passage down into the earth, the drill is reported to have passed twelve different strata of water, and at the bottom of the hole, the temperature is 233 degrees F., or considerably above the boiling point at atmospheric pressure. The heat is said to increase at the rate of about 1 degree F. for each 50 feet.

In the annual report of the Bureau of Standards, reference is made to one of the important developments made during the past year by the bureau. Surveying or mapping from airplanes has become an important method of rapidly obtaining maps of more or less inaccessible territory. One of the greatest difficulties to be overcome in accurately mapping by this method is the distortion, which even the best photographic lenses introduce, especially when lenses are also used for enlarging the original photograph. The Bureau of Standards has succeeded in practically eliminating this distortion by inserting, at the proper place in the camera, a plate of glass of the proper thickness. This device makes it possible to accurately map a given territory from the air in about one-half the time formerly required.

At a recent meeting of the Dutch Institute of Civil Engineers, it was stated that aeronautical engineers have been working on the design of a new kind of windmill that promises to be many times more efficient than the older type. The progress made so far indicates that possibly windmills, instead of disappearing, will be used in steadily increasing numbers as an important source of power. In England, well-known scientists have pointed out that the study of airplane wings and propellers has paved the way for aerodynamically efficient windmills, and that in some countries these windmills could generate electricity sufficient for all purposes. One of the difficulties in connection with the generation of electricity by windmills has been the need for very large storage battery capacity.

During the past year the Westinghouse Electric & Mfg. Co. built a small motor armature, 2 3/4 inches in diameter, to run at 15,000 R.P.M., or with a surface speed of 10,800 feet per minute. This is a series motor, driving a circular saw. Ordinarily, machinery is run with alternating-current motors at a fraction of the two-pole synchronous speed (3600 R.P.M.), but small portable tools may demand a much higher speed. This may be obtained by installing a special local power circuit for these portable tools, of 180 cycles, to feed bipolar squirrel-cage motors, which run at about 10,000 R.P.M. The necessity of a special frequency circuit limits these tools to places where they are required in considerable numbers, as in automobile body plants, metal cabinet works, and woodworking factories. The elimination of the commutator and brushes of the usual portable tool motor reduces, however, the maintenance to an insignificant amount.

A new type of insulating material which is being used by the General Electric Co. for the production of radio high-frequency insulators not only solves the problem of an improved insulator for such high frequencies as are encountered in radio work, but also solves a problem in more efficient utilization of materials. The new insulation, known as "Mycalex," is a composition of ground mica and lead borate.

Mica previously presented a difficult problem because of the enormous waste involved in its use. Obtained in Canada and India in large sheets, there was considerable waste at the mines—it being estimated that only 5 per cent of the material taken from the mines could be used. In manufacturing, there were further wastes of small pieces of mica, but some years ago, it was found that these mica flakes, mixed with a binding material and compressed under heat, made very good insulation. Such sheets of prepared mica are used by the General Electric Co. in many processes. And now a product has been developed that utilizes mica particles, so that even more of the mineral is used.

The new material has better insulating properties than porcelain, and several applications for it have been developed. The substance, light gray in color and with a metallic ring, is being used in the manufacture of bases for radio transmitter tubes, for aerial insulators in high frequency work, and for numerous similar applications.

Letters on Practical Subjects

COOLANT SYSTEM FOR MACHINE TOOLS

Two of the greatest improvements made in the metal-working industry are the introduction of high-speed steel for cutting tools and the development of the grinding machine for the rapid and accurate production of parts. To obtain the maximum results from either, it is necessary to have a good system for supplying the cutting tool or wheel with cutting oil or coolant. It may seem unnecessary to call attention to this factor, yet from an examination of the coolant systems often found on machine tools, it is evident that there are many opportunities for improvement.

The value of a large quantity of coolant delivered at a low velocity has been realized and provided for by grinding machine makers. One of the difficult problems in designing a coolant system is to make suitable provision for the removal of sediment. The writer has used one machine on which, in order to clean out the coolant tank, it was necessary to remove the pump and belt, the grinding wheel guard, and the wheel. This required considerable time, which could have been avoided by providing some form of removable tank, mounted on wheels.

A machine should not require more than twenty minutes a week for oiling and cleaning. Stuffing-boxes or glands should be avoided, if possible, by placing the pump inside the tank, as glands frequently leak and the oil drips on the floor.

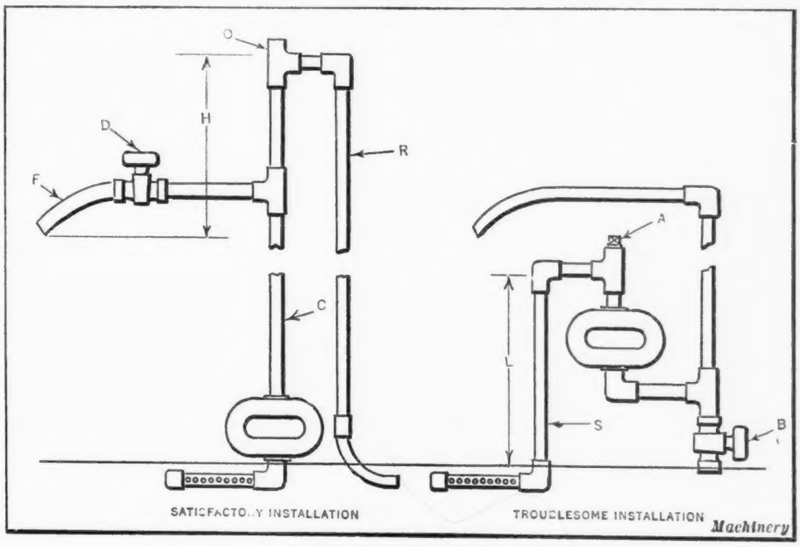
It is a good plan to place the pump as close to the surface of the coolant as possible or, better still, locate it below the surface, in order to avoid loss of time in priming. In the view at the right-hand side of the illustration is shown an outline of the arrangement of the pump and piping on a new machine tool for which we paid $2500. This coolant system gave considerable trouble until changed as shown in the view at the left-hand side of the illustration.

The lift *L* of the original arrangement, shown in the view at the right, was 18 inches, and it often took five or ten minutes to get the pump to work. The plug *A*, for priming, did not serve its purpose, because the coolant which was poured into the pipe system at this point simply ran down the suction pipe *S*, as there was no valve in the pipe. The supply of coolant was regulated by the valve *B* located on the opposite side of the machine from the operator's position. Thus, the operator was required to walk around in back of the machine in order to regulate the flow of the coolant. Every time the machine was stopped, the pump lost its priming and had to be started again.

In the altered installation shown in the view at the left, the pump is placed as close to the surface of the coolant as possible and the drive reversed. Instead of the usual spring-loaded relief valve, an open-end pipe *C*, extending above the coolant outlet pipe, is provided. This pipe is extended 8 to 10 inches above the outlet *F*, in order to obtain a head *H* that will give the necessary flow through pipe *F*. When the cock *D* is closed, the coolant returns to the tank through the pipe *R*. The pipe must be left open at *O* to prevent siphoning.

Whenever alterations are made on machines where it is not convenient to lower the pump to the surface of the coolant, a funnel can be placed at *O*, and used to guide the priming coolant to the pump.

E. G. Bishop
Sydney, Australia



Right and Wrong Methods of Piping Coolant Pump

SIMPLE WORK-HOLDERS FOR ACETYLENE WELDING OPERATIONS

Most of the time spent on acetylene welding work is often devoted to lining up the work preparatory to the actual welding. Makeshift methods may be all right for repair work when only one weld is to be made, but when a number of welds of the same kind are required, it is more profitable to use a holder, if it is possible to make or obtain one. Not only is the work speeded up by the use of holders, but better results can be obtained, because the parts to be welded are held in their proper relation to each other. It is quite possible to make an excellent weld and then find out that the work is spoiled because the parts have not been correctly lined up.

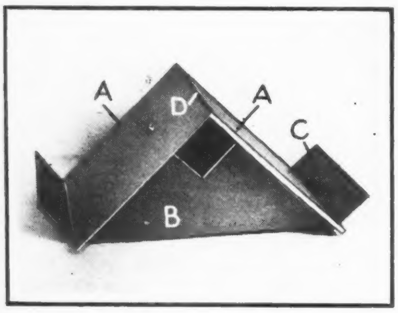


Fig. 1. Holder Used in Joining Pieces A at D by Acetylene Welding

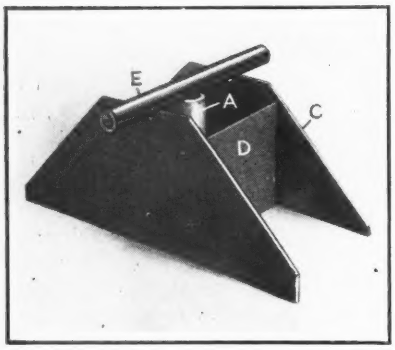


Fig. 2. Sheet-metal Holder for Pipes to be Welded in the Form of a Tee

The accompanying illustrations show two types of holders, each made from one piece of sheet metal. These examples show how sheet metal can be used to form an inexpensive holder for production welding operations. In Fig. 1 is shown a bracket holder. The right-angle brackets are made up of two thicknesses of flat stock *A* welded together. The holder *B* is cut out in one piece to form external and internal vees with a turned-up end *C* at each side. The first part of the welding operation consists in laying the two sides of the bracket on the external vees, as shown in the illustration, and welding along the peak *D*. The seam is thus welded together, and the bracket can then be turned over and laid in the smaller internal vee, in which position the inside of the seam is welded. A plan of the holder before it is bent to shape is shown at *A*, Fig. 3.

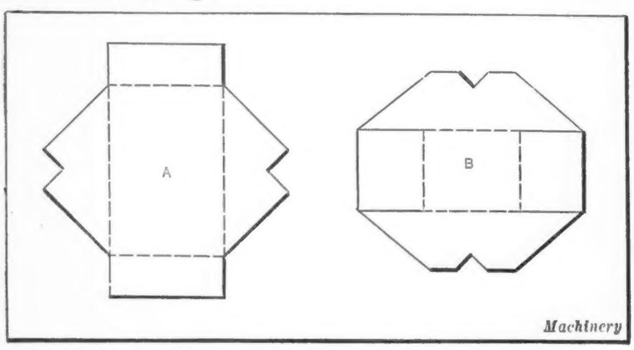


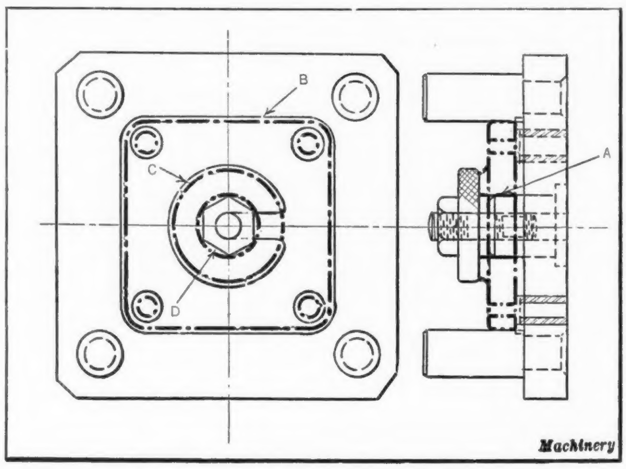
Fig. 3. Plan Views of Holders Shown in Figs. 1 and 2 Before Bending to Shape

At *B* is shown the plan of another holder, which is shown complete in Fig. 2. This holder is used in welding a short piece of heavy pipe *A* to the center of a lighter tube *E*. The holder *C* is made in one piece, with shallow vees on the top and two upturned sides *D* at right angles to the ends. In operation, the short pipe *A* is stood in the center of the holder with the tube *E* laid over it in the vee notches, as shown. In this position, as much of the welding as possible is done. The short piece of pipe is then laid on one of the upturned sides, while the other piece of pipe remains located in the vees.

Rosemount, Canada H. MOORE

ALIGNING-PAD TYPE OF DRILL JIG

The drill jig shown in the accompanying illustration is a simple device for locating pieces of work when it is necessary to consider the contour of a flange in order to maintain an even thickness of metal around the bolt holes, so as to insure strength and give a neat appearance. The jig is centralized by the plug *A* in the center hole, and the operator lines up the edge of the work with the projection *B* on the jig, which has the same contour as the work, shown by the heavy dot-and-dash lines. The piece is clamped in place by the C-washer *C* and nut *D*. The dimensions of the contour projection on the jig should be 1/64 inch greater all around than the work, thus permitting the operator to line up the work with his eye. This type of jig will be found very useful on small-quantity production work, and can be adapted to various types of pieces.



Jig on Which Work is Aligned by Means of Pad

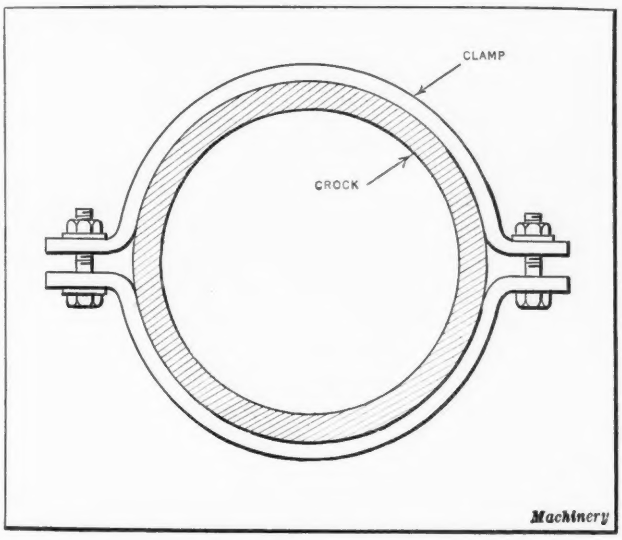
If a jig with a screw-stop is used for work of this kind, the screw may be set for one casting, and the next casting to be drilled may have a projection or rough spot where the stop-screw makes contact, with the result that the metal will be thin around the sides of some of the bolt holes. Another advantage of the type of jig shown is that the operator must necessarily consider the contour, as this is the only means of locating the work, while with a pin or screw-stop, there is the possibility of chips falling between the work and the stop. Of course, the contour jig is used only where small quantities of pieces are to be drilled and the accuracy requirements are such as are necessary in aeronautical work.

Woonsocket, R. I. N. E. BROWN

CROCKS FOR HARDENING SOLUTION

Crocks make an ideal container for holding quenching solutions, which in most hardening rooms consist of brine with a light coating of oil of vitriol on the top surface. The salt and vitriol solution does not materially affect or deteriorate the crock. An ordinary crock will last for years; the only drawback is that it is easily cracked if the side is bumped by the work while quenching.

Large crocks are expensive, and should not be thrown away just because they are cracked, as they can be made serviceable by reinforcing them with a clamp like the one shown in the accompanying illustration. Generally the crack starts from the top edge and extends down a distance of from 6 to 12 inches. The clamp is made from machine steel, 1 1/4 inches wide by 1/4 inch thick, and is fastened just under the projecting rim of the crock. After the clamp has been placed in position and tightened, it will close the crack and prevent the quenching solution from seeping through. The writer has in mind a crock that was reinforced in this way



Clamp for Reinforcing a Cracked Crock

over three years ago, and is still in serviceable condition.

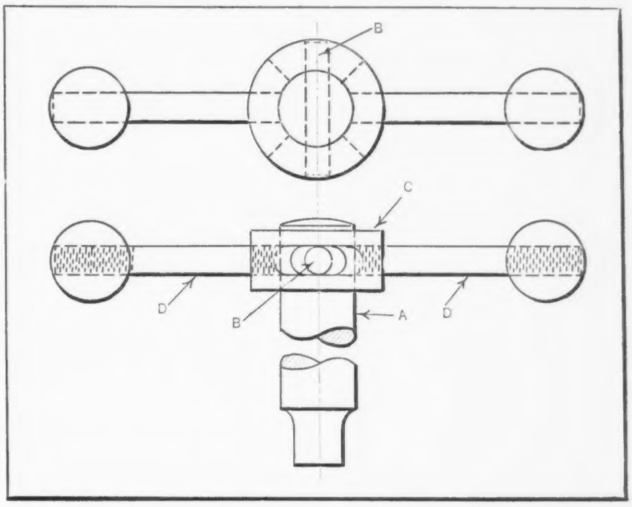
Another suggestion in using crocks for hardening solutions is to place circular lead disks, 3/8 inch thick, on the inside bottom of the crock. This lead disk acts as a cushion, so that in case the steel piece which is being hardened slips from the tongs it will drop on the lead and the bottom of the crock will not be broken. The reason for using a lead disk is that this material will not be affected by the salt or vitriol in the quenching solution.

Waterbury, Conn. CHARLES DOESCHER

HAMMER CHUCK WRENCH

A chuck wrench of unusual design, as shown in the accompanying illustration, was made recently in a small shop to meet the specifications submitted by a customer. It is intended for use in a machinist's three-jaw chuck, where a wrench having a short handle must be employed. Under these conditions, the operator acquired the habit of giving the wrench a tap with a hammer to tighten the chuck, and a tap in the opposite direction to loosen the grip.

From a production standpoint, this method of operating the chuck was not satisfactory, but as the tapping method seemed to be necessary under the circumstances, the owner designed the wrench



Chuck Wrench with Means for Obtaining Hammer Tightening Effect

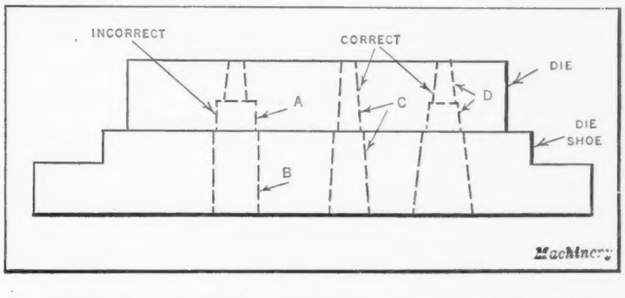
shown, which is really a hammer chuck wrench.

The body *A* is of round tool steel, squared at one end to fit the chuck and drilled through the other end to receive a pin *B*. A heavy tool-steel collar *C* fits over this end with a running fit, and is slotted on the opposite sides to clear the pin in the body. This collar is also tapped for two stud handles *D*, each of which has a round ball screwed on its outer end. The wrench is used in the usual manner to open or close the jaws of the chuck except at the final tightening or initial loosening. For these two motions, the handle is rapped by moving it around and bringing the end of the slot smartly against the pin.

Rosemount, Montreal, Can. H. MOORE

PREVENTING PUNCHINGS FROM STICKING IN DIE

Small holes in plain piercing dies often have a tendency to become clogged up by the slugs or punchings. This clogging of the die may in some cases cause the punches to be broken. The shape of the hole through which the slugs pass has a great deal to do with this difficulty. Many diemakers enlarge the lower part of the hole in the die-block or in the shoe, as shown at *A* and *B* in the accompanying illustration, allowing a clearance of about 1/16 inch for the slugs to fall through. This practice, however, does not always prove satisfactory, especially in the case of light metal.



Methods of Providing Clearance for Punchings in Piercing Die

There are instances in which trouble has been encountered even when the hole in the die-shoe is made 1/4 inch larger than the piercing punch. If there is considerable oil on the stock, the slugs stick together and have a tendency to slide. By moving around in the enlarged portion of the hole in the piercing die, the slugs become wedged into a compact mass which obstructs the hole. The result is a broken punch, and sometimes the toolmaker has considerable difficulty in removing the slugs from the hole. If trouble of this kind is experienced with small punches, it is advisable to make the piercing holes as shown at *C* or *D*. Taper-reaming the holes, as shown at *C* and *D*, for the full length of the die and the die-shoe will prevent the slugs from being wedged in the die or die-shoe.

Newark, N. J. JACOB H. SMIT

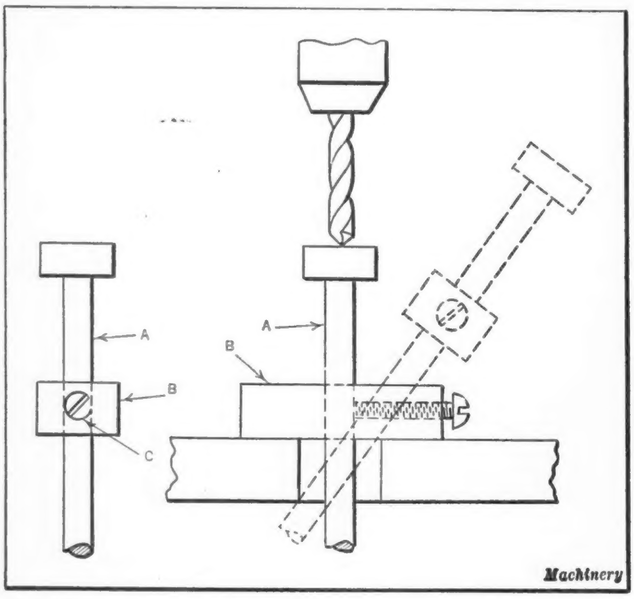
ADJUSTABLE STOP FOR SETTING DRILL

The device shown in the illustration is a useful piece of equipment for the drill press. It enables the operator to reset a drill in exactly the same position that it occupied previous to its removal and regrinding.

The tool consists of a spindle *A* in a rectangular stop *B* provided with a clamping screw *C*. The diameter of the spindle should be about one-half the diameter of the clearance hole in the table in order to permit the device to be removed when the drill is set to project the maximum amount. The dotted lines show the device in the position that it occupies when withdrawn from the drilling machine table. The length of the spindle should be great enough to suit different settings.

When a carefully set drill must be removed from the chuck for regrinding, the spindle *A* is first inserted in the hole in the table and raised until the head touches the drill point. The collar *B* is then clamped to the spindle, as shown in the view at the right-hand side of the illustration. The top end of the spindle serves as a definite stop when reclamping the drill in the chuck. This method of resetting the drill is more reliable than using a finished piece of work as a guide.

Rosemount, Montreal, Can. ARTHUR KENDALL



Stop for Setting Drill

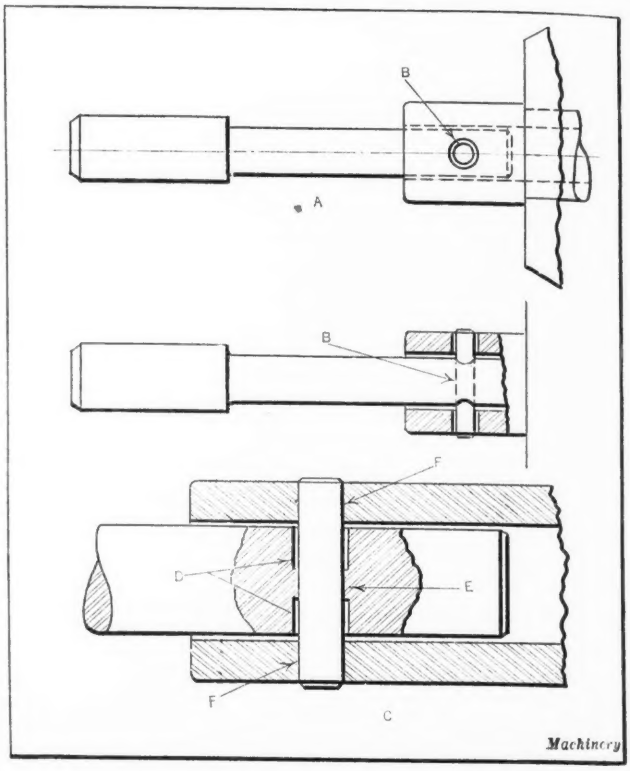


Fig. 1. Floating Reamer-holders of Usual Design

HOW SHOULD A FLOATING REAMER-HOLDER BE CONSTRUCTED?

"Shall we mount that reamer in a floating holder or shall we hold it rigidly?" This question often arises in general shop practice, and the usual answer is, "Mount it in a floating holder." We decide to float the reamer, and then look about for a holder that really floats.

Now, in the average shop there are many kinds of floating reamer-holders, the majority of them being similar in form to that shown at *A* in Fig. 1. The shank of the reamer has a pin through it at *B*, and by making this a loose fit in the hole, a floating action of a certain kind is provided. A form like that at *C* is sometimes used, where the pin is a tight fit in the shank, which is drilled out from each side nearly to the center for clearance, as at *D*, leaving the fit only at *E*. In this form, the pin is a sliding fit in the holder at *F*. These and similar forms are well known to every shop man, but it may be stated without fear of contradiction that none of these styles of holders is perfectly satisfactory.

Sometimes the writer wonders whether we have not lost sight of the main purpose of a floating reamer-holder. First, we assume that the average turret lathe is inaccurate as regards the alignment of the turret hole with the spindle. Yet manufacturers of these machines go to the greatest trouble not only to insure accuracy when the machine is first bought, but also to preserve that accuracy as long as possible by making all possible provisions against deterioration from use or neglect. The turret indexing mechanism is carefully made and tested; the holes in the turret faces are bored from the spindle itself, after the guide ways have been scraped to a fit. When the machine is first set up, we should have accurate alignment. Referring to Fig. 2, at *A* is a plan view in diagram form of the turret and spindle of a turret lathe, with a floating

reamer in position. The simple holder B presumably allows the reamer to align itself with the spindle when the turret does not index properly, but permits variations in alignment, as indicated by the lines m and n.

It is pertinent at this time to ask what misalignments are likely to be found in a turret lathe and in what direction? In the plan view shown at C, variations in indexing can easily be found by placing a bar D, about 18 inches long, in the turret, and testing with an indicator in the manner shown. To give an idea of the probable or possible errors here, the writer knows of a certain type of turret lathe on which numerous tests were made after a period of three years, which showed the variations in indexing on a long bar to be from 0.0005 to 0.0015 inch.

A similar test made as shown by the side view of the turret at F showed a variation considerably greater, namely, from 0.003 to 0.008 inch below the center of the spindle. If such a condition is prevalent, it almost seems as if the floating of a reamer in a vertical direction would be sufficient to take care of the misalignment.

The writer has never tried this experiment, but suggests that a holder made as shown in Fig. 3 should overcome all difficulty from misalignment. This holder is somewhat different from the ordinary form. It offers the advantages of simplicity of construction, rigidity and good driving power, and adaptability to various sizes without great expense.

The reamer itself, shown at A, is held by the set-screw B in the cylindrical plug C which is made a nice sliding fit in the movable steel block D. The back of this block is dovetailed at E and provided with a suitable gib at F. It is a sliding fit in a corresponding dovetail cut in the rectangular portion G of the shank H. The hole K at the back end of the clearance hole L in the member D is tapped

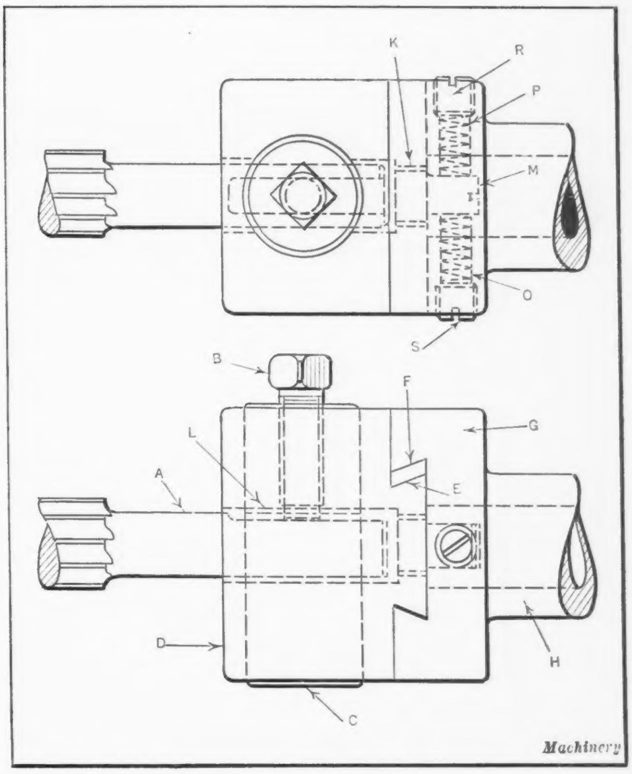


Fig. 3. Suggested Design of Floating Reamer

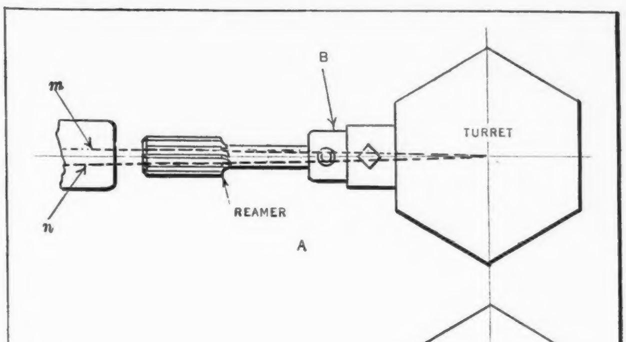


Fig. 2. Methods of Determining Misalignment of Reamer

out to receive a special screw M, which extends out into the hole in the shank as indicated. The end of screw M is flatted or squared up to take the thrust of the two coil springs O and P. The tension on these springs may be adjusted by means of the set-screws R and S.

It seems to the writer that in case of any misalignment in a vertical direction, the plug in which the reamer is mounted would adjust itself readily to the position required, and also if there were a slight amount of variation in the turret indexing, the slide would compensate for that in a horizontal direction, being restrained from traveling too far by the spring adjustment mentioned. The only condition that I can imagine for which this holder will not compensate is where a particular turret lathe has been used for a long period of time in a certain position with respect to the spindle. In such a case, the ways might be so worn that the turret-slide would tend to tip slightly, so that the turret hole would be at an angle, pointing upward or downward in relation to the center line of the spindle.

Detroit, Mich. ALBERT A. DOWD

COILING WATER HEATER PIPE

Most mechanics, when called upon to coil pipe as shown in the lower left-hand corner of the illustration at A, would spend a long time figuring out a way to make a workmanlike job of it. If they had to do it without filling the pipe with rosin or sand to avoid kinking, they would be still more puzzled as to how to proceed.

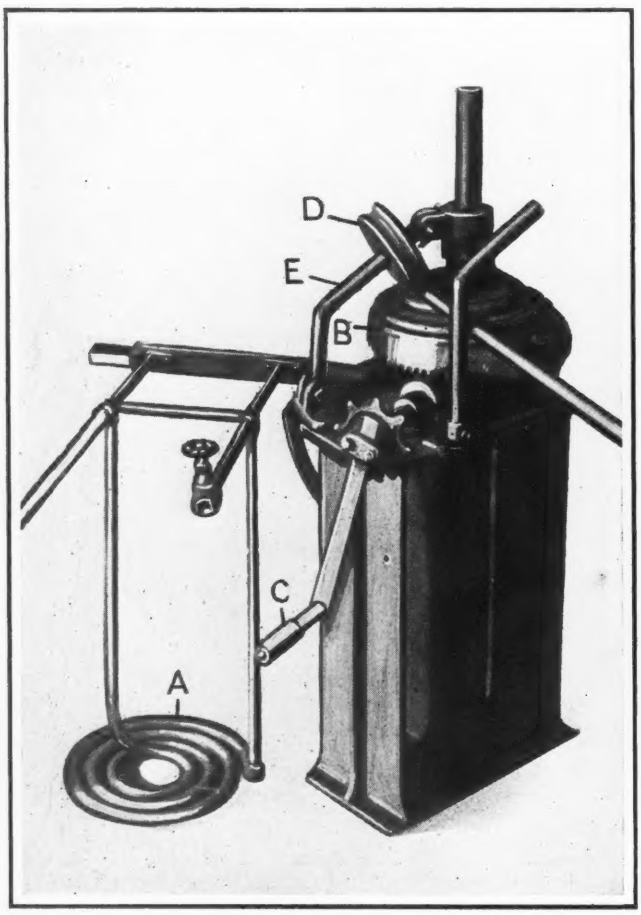
However, by using the device shown, the job is made easy, and one man can turn out a great many coils in a day. The form B over which the pipe is bent is made conical shape, with a spiral groove cut in it, like the thread on the end of a wood screw. This groove is under-cut to receive about half the

diameter of the pipe to be bent. Gear teeth cut on the under side of the form mesh with a pinion on a cross-shaft, so that the form can be rotated either by power or by turning the crank *C*.

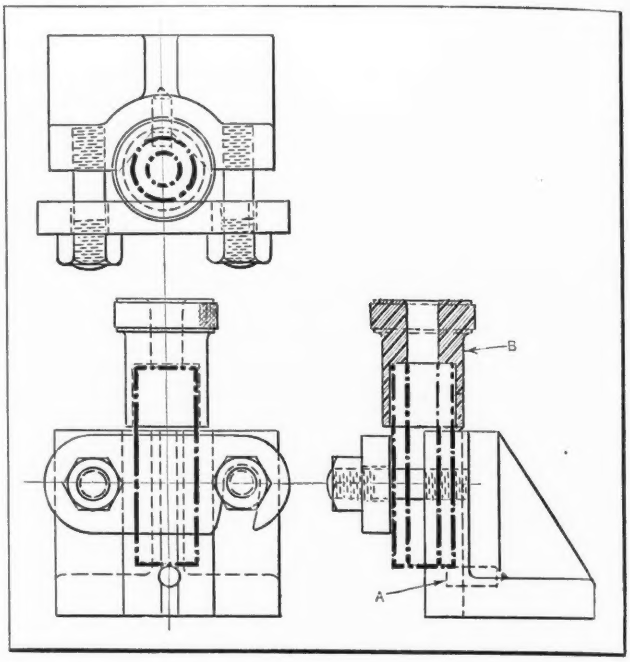
One end of the pipe to be bent is clamped to the lowest end of the forming groove, and the grooved pulley *D* is placed over it. The forming spiral is then rotated, and the grooved pulley presses the pipe into the groove, following upward on its slanting axle *E* as the pipe and formed groove travel under it. The groove in the pressure pulley and the formed groove in the rotating spiral not only force the pipe into a cone-shaped coil but also keep it from kinking without the necessity of filling the pipe. After the pipe has been coiled, the shaft, or axle, on which the grooved pulley revolves, is released and swung out of the way. The pipe can then be lifted off the form, as it has sufficient spring to permit it to be removed from the undercut grooves. The spiral pipe coil can now be easily flattened to form the heating coil seen at *A* in the illustration.

To get the best results, a forming base and a pressure pulley of the right size should be used for each size of pipe, but in an emergency, a fair job can be done on smaller pipe with the same outfit, if care is used. Any pipe threading that may be required should, of course, be done before bending. The pipe shown is regular 3/4-inch steam pipe, but the same style of bender may be used for brass or other pipe, and will produce uniform coils, free from kinks, dents, or buckles that do not require heating or filling for the ordinary commercial run of work.

Cleveland, Ohio — AVERY E. GRANVILLE



Machine for Coiling Water Heater Pipe



Drill Jig for Wrist-pin

JIG FOR DRILLING HOLE THROUGH WRIST-PIN

In the accompanying illustration, is shown a drill jig for use in drilling the holes through wrist-pins on which only a small allowance is made for grinding the outside of the pins to bring them to the required diameter and concentric with the drilled holes. The required accuracy could not be obtained on the machine originally employed for cutting off and drilling the pins. With the new method, the machine was used only for cutting off the pins from the bar stock, after which they were drilled in the jig shown.

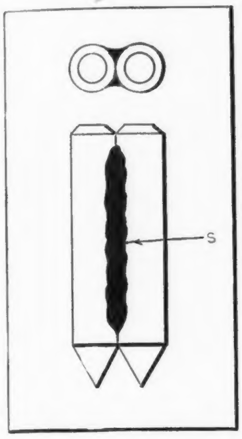
The method of holding a pin is clearly shown in the illustration. After the pin has been clamped in place with the end resting on the stop-pin *A*, the bushing *B* is slipped over the projecting end of the wrist-pin and the hole drilled half way through. The pin is next turned, end for end, and the drill bushing replaced, after which the remaining half of the pin is drilled. It is then a simple matter to countersink the ends of the pin for the grinding operation on the outside of the stock. This method of machining the pins permits stock having only a small allowance for grinding to be used.

Buffalo, N. Y. — C. W. PUTNAM

* * *

The fourteenth national foreign trade convention was held at Detroit, Mich., May 25 to 27. Herbert Hoover, Secretary of Commerce, was the outstanding speaker, his subject being "American Foreign Trade." Group sessions, which proved especially helpful to exporting manufacturers, dealt with such subjects as foreign credits and credit information, export advertising, and banking facilities for export trade. One session was devoted entirely to Canadian trade and was conducted in cooperation with the Canada Board of Trade. A group of Latin-American business men, who had previously attended the Third Pan-American Commercial Conference earlier in the month, attended the convention.

Shop and Drafting-room Kinks



Spacing Center-punch Made from Drill Rod

SPACING CENTER-PUNCH

In the accompanying illustration, is shown a spacing center-punch which should be of interest to toolmakers. The punches are made from drill rod of the proper size, the conical points being turned in a bench lathe. After the points are turned and the punches cut off to the same length, they are held together by wires or a clamp and joined together by soldering at *S*.

CHARLES KUGLER
Philadelphia, Pa.

SLOTTING STEEL PLATE WITH DRILL

The plate *A* shown in the illustration was required to have a slot 1 inch wide by 2 inches deep cut in one side, as indicated. As no milling machine was available and the work was required at short notice, the following kink was employed.

Pieces of scrap iron *C* and *D* were placed on each side of the piece, as shown in the view at the left. Next, all three pieces were clamped in a vise, and a 1-inch hole drilled in the center of the plate *A*. The bottom of the hole was then squared up with a flat-end drill. After removing the plates *C* and *D*, the edges of the slot were filed down square with the sides of the plate. This method of producing the slot was much quicker than drilling small holes through the side of the plate and then chipping and filing away the excess metal.

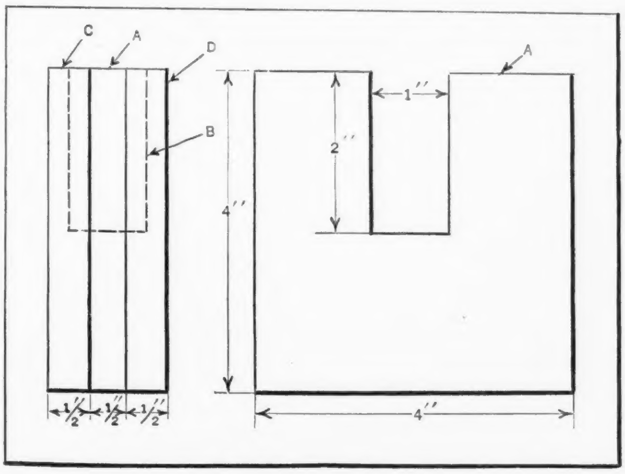


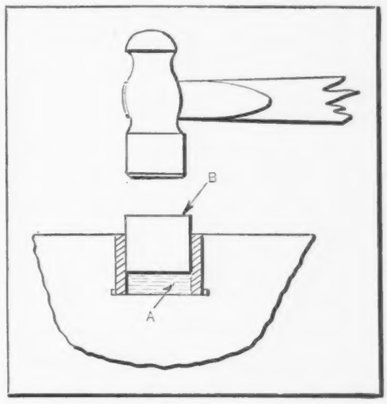
Plate with Slot Cut by Drill

Denver, Col. R. M. THOMAS

REMOVING BUSHINGS FROM BLIND HOLES

The usual practice, in removing a drive fit bushing from a blind hole is to cut or grind out the entire bushing, the method employed depending upon the hardness of the metal. Although this practice may be justified when only a single bushing is to be dealt with, it is obviously unsatisfactory in cases where large numbers of bushings are to be removed.

The method shown in the accompanying illustration is rapid and requires no special tools. It consists of placing oil in the bushing at *A*, inserting a plug *B*, which is a close fit in the bushing, and driving down the plug. It is surprising how quickly the bushing will be forced up when the plug is tapped. The plug *B* has practically the same action as the piston of a hydraulic jack and the pressure developed is sufficient to force the bushing out, regardless of the fit. The method requires no heavy hammering, and the plug is not injured in any way.



Method of Removing Bushing

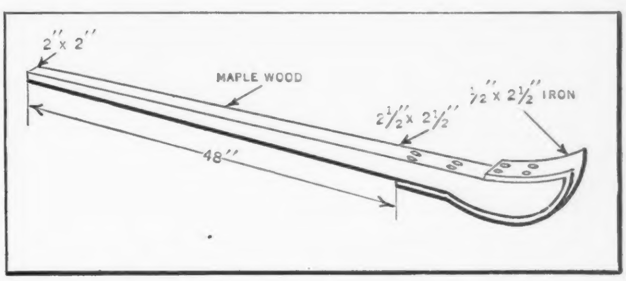
Philadelphia, Pa. J. F. HARDECKER

LIFTING BAR FOR HEAVY WORK

The bar here illustrated is designed for use around the shop and shipping room. It has many advantages over ordinary crowbars for moving heavy machinery on rollers and skids. With this bar, it is not necessary to use blocking for extra leverage, and it is therefore much safer to use. It also has considerably more power, and millwrights and others who have a great deal of handling of heavy machinery will appreciate it.

The bar is made of clear grain maple, oak, ash, or any suitable wood, shaped as shown. The corners of the handle are rounded and sandpapered. The bar is tapered and bulged on one end to a semi-circular section. This end is reinforced with 1/2- by 2 1/2-inch iron, which is bent to shape in the forge. The iron is drilled for bolts and lag screws, which are used to secure the iron piece to the wood bar, as shown in the illustration.

Syracuse, N. Y. H. L. WHEELER



Bar for Lifting Heavy Work

Questions and Answers

DRILLING A VERY SMALL HOLE IN GLASS

E. F. P.—Can any of MACHINERY'S readers tell me how to drill or form in a piece of glass a hole 0.0002 or 0.0003 inch in diameter?

Answered by C. G. Williams

A.—In reply to the question on page 536 of March MACHINERY: "Is it practicable, by using a steel lap and diamond dust, to drill or lap in glass, a hole as small as 0.0002 inch?" the writer would not go on record as stating that it is a production operation, yet it is possible to drill very small holes in glass, and although he has not drilled holes as small as 0.0002 inch he has drilled holes 0.0015 to 0.002 inch in diameter in plate glass up to 7/16 inch thick.

A soft steel wire, double annealed and of the diameter of the hole required, was placed in the chuck of a high-speed drill, leaving 1/8 inch more wire extending from the chuck than would be required to reach through the glass. Next, a very small drop of castor oil was placed on the glass at the point to be drilled and a minute quantity of diamond dust placed on top of the oil. In drilling the hole, it is necessary to just touch the glass two or three times at first, after starting the drill, in order to pick up the diamond dust on the point of the wire. It may then be necessary to place a little more diamond dust in the center of the drop of oil in order to fully charge the steel before the hole is really started.

When the hole is once started, it should not be necessary to use more dust when drilling holes in glass up to 3/8 inch in thickness, although it may be well to do so when starting with a new wire. If the wire has been used once, it will have picked up a supply of dust from the former drilling operation, so that a smaller amount of dust will be needed for drilling the second and all subsequent holes. It is necessary that the wire have a flat level face on the end that bears evenly on the glass or it will not produce a straight hole and the hole is likely to be three-cornered as well as crooked.

LEGAL RELATION BETWEEN EMPLOYER AND MINOR WORKMEN

I. F. K.—What is the legal relation of an employer and a minor workman, and when do minors become of legal age?

Answered by Leo T. Parker, Attorney at Law, Cincinnati, Ohio

It has been held that the relation of an employer and a minor workman is similar in many respects to the obligations of a renter who has permission to utilize a particular thing for a specified purpose. Where the use is changed, the liability of the renter automatically increases. When an employer is careful to obtain the consent and permission of a parent to employ a minor for dangerous work and does not breach the contract by ordering the minor to do more dangerous work, the actual liability is no more than where an adult is employed.

For the reason that many states have enacted statutes that regulate the liability of an employer who hires a minor workman, it is advisable for all employers to know the provisions of these laws, because if a minor is injured or killed directly as a consequence of an employer violating a statute, the law is well established that an employer may be held liable for damages and other more severe penalties, because under these circumstances the gross negligence of the employer may be presumed. Also, where the legislature regulates the ages at which minors may be employed, an employer who violates the provisions may be liable to prosecution for violation of the laws.

An infant or minor is legally defined as any person who has not arrived at the age of majority as prescribed by law. At common-law the legal age is twenty-one years for both male and female. Many of the state legislatures have regulated the legal age of majority of both male and female at twenty-one years. However, in Arkansas, California, Colorado, Illinois, Kentucky, Maryland, Minnesota, Missouri, Nebraska, Pennsylvania, and Vermont, the legal age of a male is twenty-one years, and of a female eighteen years.

A very interesting case recently was decided in which the chief point of discussion was the exact moment at which a person became of legal age. The court held, in effect, that a person actually becomes of full age on the day preceding his twenty-first birthday. In another case where the same point of law was involved, the court held that a person becomes of full age at the first minute of this day. But in still another case, where the liability for damages rested on the determination of only a few minutes, the court decided the litigation by holding that the legal age of majority is the same minute of the day preceding his birthday, of the required years, as the minute of the corresponding day on which he was born.

* * *

Twenty-seven employes of the General Electric Co., Schenectady, N. Y., were recently awarded the Charles A. Coffin Foundation certificates of merit for their outstanding services toward the increase of the company's efficiency or progress in the electrical field during 1926. With each certificate went four shares of the General Electric Co.'s common stock. Nine of the twenty-seven awards were to workmen in the shops, two to foremen, eight to engineers, five to commercial employes, and three to administrative employes. The Charles A. Coffin Foundation was founded by the General Electric Co. in 1922 in recognition of the services to the electrical industry of the late Charles A. Coffin, first president of the company, who died last summer. Yearly prizes are also awarded by the foundation in the electric railway and power fields.

What MACHINERY'S Readers Think

Contributions of General Interest are Solicited and Paid for

GUARDING PATENTABLE IDEAS

The information in the article "What is a Patentable Invention?" in March MACHINERY is very valuable as far as it goes, but the writer would like to offer a few ideas that will be of considerable value when there is a question as to priority and as to who should be entitled to a favorable decision because of being the original inventor.

The moment an idea is conceived it is of great value to make a simple sketch, properly dated, and witnessed by someone that signs the sketch. It is not necessary that the witness understand the function of the invention or idea pictured by the drawing. It is sufficient that he sign his name on the sketch as witness to the effect that the sketch was made on a certain date.

A scrap-book is the best method of keeping a record of both the first conception and later developments of an invention, each being witnessed, signed, and dated as previously stated.

In the case of a valuable idea, it is advisable to avoid disclosing the invention to anyone who may be capable of using the idea or transmitting it to others who may take advantage of it. The fact that a witness need not understand the nature of the invention makes it possible to obtain a witness to whom the nature of the invention need not be disclosed.

There has been a great deal of dishonesty in connection with patents, and the inventor must protect himself in as far as he is able to do so by not disclosing certain facts relating to his invention that would aid an unscrupulous infringer. There is no need of disclosing the date of the original conception of an idea to anyone, after a record such as has been proposed has been made; and if an assignment is to be made on a pending patent, a contract to do so is quite valid without disclosing the filing date of the patent. It is not advisable to record an assignment of a pending patent, as that will disclose the filing date, and will give an unscrupulous infringer information that will help him to build up a record that can be used against the true inventor. I have had some experiences along these lines myself, and my advice is based upon what I have learned in practice.

JAMES MCINTOSH

WASTING TIME ON SHOP DRAWINGS

A great deal of time is wasted in many drafting-rooms in making shop drawings. The writer believes in system, but in some drafting-rooms the system has become the important thing and the fact that drawings are merely a means to an end has been lost sight of. Every little thing is drawn and redrawn until it "looks right," and then traced and retraced, and sometimes made all over again. Then it is indexed and cross-indexed, and lettered and dimensioned with pluses and minuses.

I have seen little sheets about 12 by 18 inches that were said to have taken the time of one man over a month. They were beautiful, with not an erased spot on them, the lettering was uniform and elegant, but—the drawing was to be used but once for one or, at most, six pieces. It was not even to be sent outside of the shop, and it cost the concern as much as, perhaps, $200, including office overhead.

And when it was at last printed and sent out into the shop, what was the effect? It was so completely dimensioned that it bothered the workmen and in some cases retarded, instead of aided, in performing the work—sometimes actually causing spoiled work. Again, the very appearance of the drawing caused the workmen to be over-particular and exact on work that did not require accuracy and so resulted in additional waste of time in the shop.

The draftsman should be made to realize that drawings are merely a means to an end and that judgment should be used in deciding upon what type of drawing is necessary for each particular class of work. A drawing is simply an instrument of service and not a work of art. Quite a complete drawing can be made in a few hours at the cost of a few dollars for drawing and prints, and it will serve the purpose for which it is intended as well as, or better than, the elaborate drawings described in the previous paragraph.

If the drawing is to be used but once, it need only be drawn in pencil. A pencil tracing may be made on cloth or paper and the outlines and the machine shop dimensions inked in. The sections and the figures required by the pattern shop may be shown in pencil only. When a print is made from such a tracing, the machinist can find the dimensions in which he is interested very easily, and the patternmaker can also readily distinguish the figures that he needs.

Of course, pencil figures do not print so well and sharply, but the patternmaker usually works in a well lighted shop and the figures are used but once, because when the pattern is once made they are no longer required. Should it be deemed necessary, however, the pencil figures can be inked in red ink, making them more distinct, but this is seldom required.

When the work in the drafting-room is conducted as described in the last paragraphs, the draftsman's work becomes more interesting to him and, therefore, less irksome, because it has greater variety. The work is speeded up both in the drafting-room and in the shop. The shop man finds on the drawing just what he wants, and no workman is tempted to waste time trying to do more accurate work than the particular job requires. The result of all this is more economical production, reduced costs, reasonable prices, and satisfied customers.

FREDERICK W. SALMON

HOW TO DEAL WITH SCRAPPED WORK

At intervals I have noted in MACHINERY'S columns discussions relating to problems confronting manufacturing concerns. Ours is a medium-sized concern manufacturing machine tools. One of our problems is how to deal with scrapped work. We want to determine the best method for eliminating the waste of time and material due to the necessity for scrapping parts. We have several ideas of our own and others have been suggested to us by our employes and by men from other manufacturing plants, but before putting any of them into effect we would like very much to obtain an expression of opinion from readers of MACHINERY who have had the same problem to deal with and who have found a remedy for it.

The following methods employed by other manufacturers have been suggested to us:

1. Make a record of all work that each man spoils, and when the time comes for an increase in pay, use that information as a deciding factor. Also, the same record should be taken into consideration if it is found necessary to lay off employes because of lack of work.
2. Charge all time that has been spent on spoiled work against the man who spoils it.
3. Charge the time wasted against the man, and if the work can be reclaimed, give the man a chance to redeem it on his own time. If the work is then passed by the inspector, he will be paid and obtain his bonus, the same as if the work had not been spoiled.
4. If a man spoils work on which there is a bonus, he is paid his day rate only, but forfeits the bonus.

All of those consulted state that when the men are charged for time spent on a spoiled piece, it makes them more careful and less likely to produce work that has to be scrapped. M. T. C.

WHY I USE THE T-SQUARE AND THE TRIANGLE

The article on page 566 of April MACHINERY "Why Do We Stick to the T-Square and Triangle?" prompts the writer to make the following remarks: I have done more or less drafting for the last forty years and feel that there is no limit to what can be done with the T-square and the 60-30 degree and the 45-degree triangle. I consider the T-square and triangle most efficient for general drawing work, particularly on large drawings. By the use of the T-square, a continuous line may be drawn the full length of a large drawing-board, whereas with a drafting machine, the scale must be moved several times. Unquestionably, the drafting machine has its place, but I am inclined to believe that this place is for the smaller drawings rather than for the larger ones.

There is one thing, however, on which there can be no difference of opinion, and that is that the triangular scale, which is now in such common use and which is almost invariably picked up wrong end to or upside down, is the most antiquated instrument used in a drafting-room.

As regards a draftsman sitting on a high stool, I should say that he has a decided advantage over a draftsman who sits on a low stool with his drawing-board correspondingly low. When a high drawing-board and stool are used, the draftsman may stand on the rungs of his stool and thereby reach the top of the drawing-board. For work near the middle of the drawing-board or at the bottom, he is in a better position with a high board than with a low one, and is able to bend over the drawing and see the line at the upper edge of the T-square.

I am an advocate of the high drawing-board. It need not be set on trestles, but can be placed on a good substantial table with wedges under the board to give it a slight slope toward the draftsman, and the slope may be adjustable if desired. I am also opposed to a draftsman trying to work over a large drawing-board when sitting on a stool, no matter how high or low the stool may be. The draftsman's best and fastest work can be done while standing on his feet, which permits him to reach all parts of his drawing-board with a slight movement of the feet or body; in this position, he does not have to get up from the stool, move it, and sit down again, before drawing a few lines, let us say, at the upper right-hand corner of the board.

Bookkeepers have tried working at sitting down desks and swivel chairs, and my observation has been that the work cannot be done so neatly nor so expeditiously as when they are standing up. There may be certain work that can be done at a low desk from a swivel chair as well as standing up and working at a high desk, but from what I have seen in drafting-rooms and bookkeeping departments, this condition is decidedly an exception.

This is not written with any idea of starting a controversy with the previous writer, as the class of work in which he is engaged and the class of work that I have been used to may be altogether different, but the idea is simply to express an opinion that the old-fashioned drawing-board, T-square and triangles have not altogether passed their day of usefulness. J. A. THOMAS

* * *

MILLER MEDAL FOR ACHIEVEMENTS IN WELDING

At the annual dinner of the American Welding Society, held in New York the latter part of April, President F. M. Farmer announced the donation of an award, the gift of Samuel Wylie Miller, consulting engineer of the Union Carbide & Carbon Research Laboratories, Inc., to be presented by the society annually in appreciation of work of outstanding merit in advancing the art and science of welding. The award is a gold medal which will be known as the Miller Medal. The details for the administration of the award have not yet been decided upon. Mr. Miller's object in making this award is to promote an appreciation of better welding and to encourage the study of those fundamentals that will lead to raising the quality of work done by the average operator.

Mr. Miller has been one of the outstanding figures in the advancement of welding. He is a past president of the American Welding Society and an active member of the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, and other scientific and engineering organizations.

IMPORTANT CHANGE IN PATENT LAWS

By LEO T. PARKER, Attorney at Law, Cincinnati, Ohio

A new law has just become effective by which the previous legal method of marking patents is changed. This law reads as follows: "It shall be the duty of all patentees and their assigns and legal representatives, and of all persons making or vending any patented article for or under them, to give sufficient notice to the public that the same is patented; either by fixing thereon the word 'patent' together with the number of the patent or when, from the character of the article, this cannot be done, by fixing to it or the package wherein one or more of them is enclosed, a label containing the like notice. Provided, however, that with respect to any patent issued prior to April 1, 1927, it shall be sufficient to give such notice in the following, viz: 'Patented,' together with the day and year the patent was granted; and in any suit for infringement by the party failing so to mark, no damages shall be recovered by the plaintiff except on proof that the defendant was duly notified of the infringement and continued, after such notice, to make, use or vend the article so patented."

Heretofore, the owners and assignees of all patents, and the makers of patented articles, were required by the law to mark patented articles with the word "Patented," together with the number of the patent or the day and year the patent was granted. However, with the new law in effect, a notice of "patented," with the date the patent was granted is insufficient, and an inventor thus marking his product is deprived of damages until after a notice is sent to the infringer notifying him of the number of the patent. In other words, the only notice that is legal on patented articles, the patents on which are granted after April 1, 1927, is: "Patent, (patent number)." Also, note that in the new law the word "patented" formerly used is replaced by the word "patent."

* * *

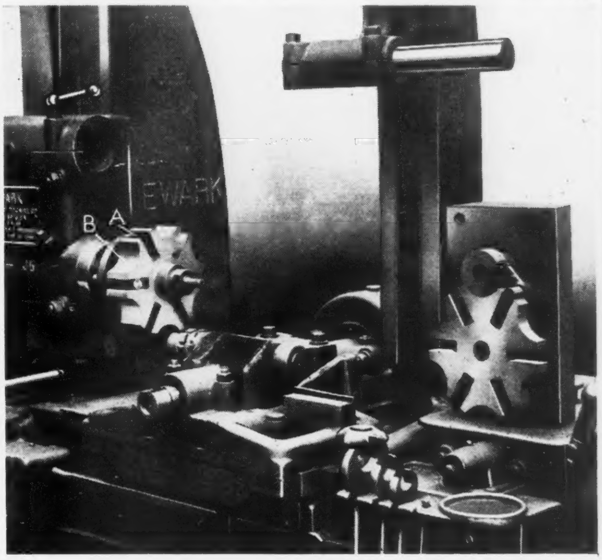
CUTTING GENEVA WHEELS ON A SPUR GEAR CUTTING MACHINE

Gear-cutting machines may often be used to advantage for operations other than gear-cutting, especially when the work requires accurate indexing. The illustration shows a Newark spur gear cutter producing, in quantity, Geneva wheels or cams used in connection with the well-known type of intermittent movement. There are two operations, the first being that of milling the deep slots *A*, and the second, milling the arcs *B* on the periphery, used in locking the wheel during the idle period.

In milling the deep slots, the cast-iron blanks are held two at a time on a nut arbor in the work-spindle. The slotting cutter is mounted on the regular cutter-spindle and the operation of milling the six equally spaced grooves or slots is practically the same as cutting a spur gear, except that the indexing movement is much larger.

In milling the circular locking surfaces between the slots, the right-angle cutter-spindle attachment, such as is used for automatic drilling and similar operations, is employed, as shown in the illustration. Two cutters are used, one for roughing and the other for finishing. The roughing cutter in the advance position leaves about 0.005 inch for the finishing cutter. To avoid play when the Geneva wheel is locked, it is important to mill these arcs to a perfect radius and obtain a very smooth surface. This may be done readily by using the duplex cutter, and 500 of these wheels or cams have been machined without any perceptible change in the diameter of the finishing cutter. For the second operation, the cams are also held on a nut arbor, which is equipped with a locating pin that closely fits into one of the slots, thus insuring accurate register between the slots and the locking arcs.

The fixture used for testing the Geneva wheels may be seen at the right of the illustration. Owing



Milling Accurate Geneva Stop Cams on a Newark Gear-cutting Machine

to the massiveness and the rigidity of the gear cutter and the accuracy of the dividing mechanism, the cams produced are unusually accurate, the maximum accumulative error being only 0.0005 inch. To obtain such accuracy, however, it is necessary to rough out the slots and then allow the cams to season at least a day before proceeding with the finishing operation.

* * *

MANAGEMENT CONFERENCE IN ROME

The third international management conference will be held in Rome, Italy, from September 5 to 8. The program of the convention is to deal with the scientific organization of industrial production, agriculture, and commerce, public service and public utilities, and domestic economy. Those submitted by the committee on American participation are now in preparation, covering management problems in manufacturing, marketing, simplified commercial practice, office administration, government and municipal administration, railway administration, agriculture, household management, and education in the field of industrial engineering.

A program of entertainment is being arranged which will include visits to the museums, artistic treasures, and scenic beauties of Rome and other cities, with the necessary guides and interpreters. Further information can be obtained from Dr. H. S. Person, secretary of the Committee on American Participation in International Management Congresses, Room 611, 29 W. 39th St., New York City.

The Machine-building Industries

THE only serious cloud on the business horizon during the past month has been the Mississippi Valley flood, and what effects the losses due to this disaster may have on business as a whole, it is impossible to foretell. Industrial activity in general has proceeded at a rate equal to that of last year. Complete statistics are available only up to the end of March, but the Federal Reserve Bank states that during that month production was larger than during the corresponding month a year ago.

In April, steel mill operations were somewhat curtailed, compared with the high level reached in March, and the bituminous coal output was reduced by about 40 per cent, due to the miners' strike beginning April 1. Production in other fields increased, however, the output of automobiles in April being practically equal to that of a year ago. The value of building contracts awarded in March was larger than at any previous time, and the production of building materials increased considerably. During recent weeks, however, car loadings have fallen off due somewhat to reduced shipments of coal, but they are still considerably ahead of the car loadings for corresponding weeks last year.

Prospects of Business Indicate Continued Activity

The prospects in the iron and steel and machine-building industries are indicated by the report made by the Atlantic States Shippers' Advisory Board for the present quarter, from which it appears that it is expected that the iron and steel output for the second quarter of this year will be approximately the same as for the corresponding period of 1926. "It is not likely to exceed it," says the statement, "although reports from one or two parts of the territory covered are optimistic and slight increases are hoped for."

In the machinery field, it is expected that the railroads will be requested to handle 20 per cent more freight than during the second quarter of 1926, and about 10 per cent more business than during the first quarter of 1927. Concerning the general conditions of the industry, the report states that they are good.

The general business conditions in the electrical industry, as expressed in the report referred to, indicate no radical change during the second quarter of the year. While there has been a certain slowing up, indications point to a continuously sustained business of approximately the same volume as last year. The shipments of the automobile industry are expected to exceed those of the second quarter of last year by 10 per cent.

The Iron and Steel Industry Reduces Production

Steel production continued at 90 per cent of capacity during the better part of April, having dropped from the March average of 94 per cent, which is practically record production. In May, the steel ingot production dropped to approximately 85 per cent of capacity. It is worthy of note that although there was a reduced output in April, as compared with March, indications are that the April output was a record for that month. The coal strike has had no effect on the iron and steel industry.

Machine Tools and Small Tools

In the machine tool field, conditions during the past month have varied considerably according to the types of machinery built. High-production equipment has been in fair demand, and some manufacturers concentrating on that field have had good business. The demand for what is generally termed "standard" machine tools has not been so brisk as in the earlier months of the year.

The small tool industry has been quite active. The demand for almost all types of small tools has been good, and the same is true of accessories, such as lathe and drill chucks. The activity in the automobile plants has stimulated the small tool business to a considerable extent.

Exports of Machinery Increase

The exports of industrial machinery increased during March, the last month for which complete statistics are available, amounting to over $14,000,000. This represents a gain of $1,150,000 over the corresponding month in 1926, and almost $2,000,000 over February this year. The export trade in industrial machinery for the first quarter of 1927 has been maintained at a much higher level than during the three corresponding months of 1926, and has also been greater than the average for the entire past year. The exports of metal-working machinery during March amounted to $1,746,783, an increase of about $110,000 over the corresponding month a year ago. The exports of metal-working machinery during the first quarter of 1927 amounted to almost exactly $5,000,000, an increase of $400,000 over the first quarter of 1926.

In the metal-working machinery group, the exports of engine lathes increased from $162,600 to $269,600 during the first three months of 1927, as compared with the same period in 1926. Turret lathe exports increased from $82,200 to $125,700; planer exports, from $3000 to $41,800; and shaper and slotter exports, from $71,700 to $130,600.

The Automobile Industry is Regaining its Momentum

April production and sales of automobiles showed gains in the case of almost all manufacturers, there being only two outstanding exceptions, and in spite of the fact that two of the largest builders of automobiles produced much less than a year ago, April production of the industry as a whole was very close to the high figure of a year ago. The total production during the first quarter of this year was 14.2 per cent below the same period in 1925, but the loss was almost entirely in two of the lower-priced cars, while almost all other manufacturers recorded a higher output than last year.

New Machinery and Tools

The Complete Monthly Record of New Metal-working Machinery

NILES-BEMENT-POND IMPROVED MACHINES

Five machines of changed design have recently been brought out by the Niles Tool Works Co., Division of the Niles-Bement-Pond Co., 111 Broadway, New York City. The improved machines include a 58-inch extra heavy locomotive-rod milling machine, a No. 3 cotter-way and keyseat miller, a No. 4 car-wheel lathe, a 90-inch wheel quartering machine, and a double-frame steam hammer.

Fig. 1 shows the rod milling machine. It measures 58 inches between the housings, and the table is 54 inches wide by 16 feet long, accommodating six of the largest locomotive rods for edging, slabbing, or channeling operations. The new features of this machine include a cross-rail down-feed that is entirely independent of the table feed both in amount and direction, thus allowing the operator to select the proper down-feed without considering the amount of table longitudinal feed. Another advantage is a greatly increased feed range. This feature is of value in "sinking" milling cutters into work and in obtaining the proper radii on rods. It has also resulted in simplification and centralization of controls at the operator's working position.

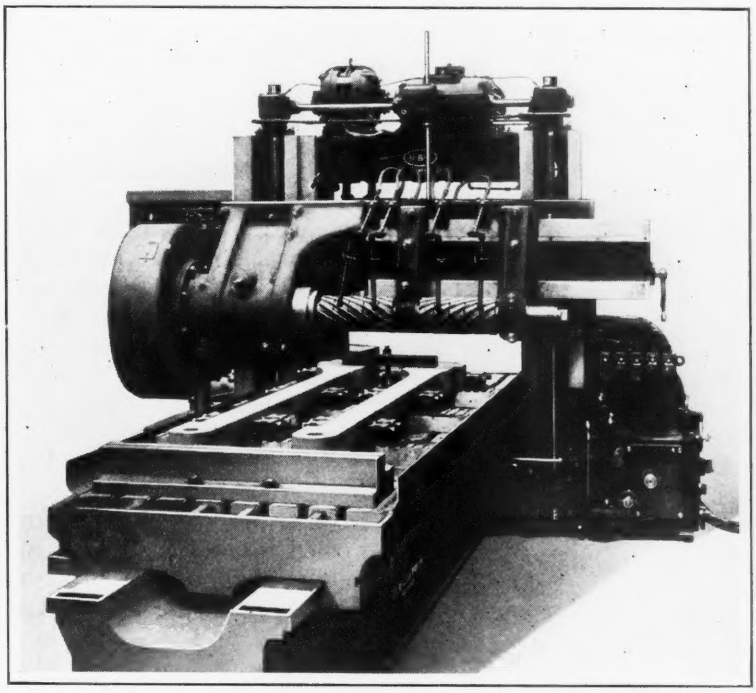


Fig. 1. Niles Locomotive-rod Milling Machine

The cross-rail is an L-shaped casting which carries the cutter-spindle and quill at the left-hand end, as well as a large worm-gear drive-box. The cutters are driven by a 75-horsepower motor, mounted on a plate at floor level, which transmits power to the cutter-spindle through a large worm and worm-wheel running constantly in oil. The cross-rail is suspended by two screws which have ball thrust bearings at the top and are anchored at the bottom to prevent buckling due to upward thrusts. Rapid vertical movement of the cross-rail is obtained by power, and there is a wide range of automatic vertical feeds. Fine adjustment by hand is obtained through a ratchet lever at the operator's end of the cross-rail.

The table feed and traverse mechanism is operated by a 10-horsepower motor mounted on a gear-box on the right-hand housing. Feed and traverse gears deliver power to the main feed-shaft from which the drive is transmitted through a spiral gear and a rack bolted to the under side of the table. The table may be locked in position so that channeling cutters can be fed down into the work without danger of table movement. Table feeds ranging up to 12 inches per minute are available, while the rates of rapid traverse range up to 20 feet per minute. Power for the cross-rail feed and rapid traverse is obtained from a five-horsepower motor on the cross-tie. The cross-rail feeds range up to 3 inches per minute, and the rapid traverse up to 16 inches per minute.

Both the cross-rail and table feeds are operated independently of the main driving motor, but the electric control equipment is so arranged that neither the table feed motor nor the cross-rail feed motor will run unless the driving motor is in operation. Failure of current to the driving motor results in disconnecting both feed motors from their source of power. However, either or both of these feed motors may be engaged momentarily for rapidly traversing the table or for elevating or lowering the cross-rail, without operating the driving motor. Fixtures that are adjustable for various sizes of rods may be furnished.

The machine illustrated in Fig. 2 was designed primarily for milling cotter-ways and keyseats in locomotive cross-heads, piston-rods, axles, etc. High spindle speeds and an improved collet construction also make the machine suitable for milling keyseats in many smaller jobs. The machine has a capacity for milling splines up to 36 inches long, 2 1/2 inches wide, and 16 inches deep. The chuck jaws grasp work up to 12 inches in diameter.

The carriage has a reversible longitudinal movement on the bed, four different rates of feed ranging from about 0.8 to 26 inches per minute being available. The feed is derived through a screw located centrally with the bed. Automatic reversal of the table is obtained by means of trips which can be set to give a stroke of any desired length. The two spindle heads mounted on the carriage

may be adjusted transversely and fed automatically toward the axis of the work. The spindle heads may be used independently or in unison, depending upon whether single or opposite keyways are to be cut or whether through slots are to be milled. Cross-feeds of the cutter-spindles range from approximately 0.004 to 0.030 inch. The spindles are arranged to receive taper sockets for holding cotter drills. In such operations as when two opposing drills are cutting through a slot, an automatic stop disengages the drive to one of the drills when the two come close to each other in the center of the work. There is regularly furnished a pair of self-centering chuck jaws which are fixed for height and are adjustable longitudinally along the bed.

Improvements recently made in the No. 4 car-wheel lathe, which was described in June, 1925, MACHINERY are illustrated in Fig. 3. These improvements include cam-locked tool-rests and fully automatic driver dogs. The cam-locking device of the tool-rests supersedes the removable wedge formerly used. The central turret clamping bolt is now surrounded by a heavy spring and a ball thrust race, so that when this bolt is released, most of the weight of the turret block is absorbed by the spring. This is accomplished without actually raising the turret from its seat and, with the aid of the ball thrust, indexing can be accomplished with little effort. Each tool-rest is equipped with an air hose for clearing away fine chips and dust accumulated during turning operations.

The new automatic driver dogs may be conveniently adjusted radially to suit different diameters of wheels. There are four dogs to each face-plate, their design insuring that all jaws will be in contact with the wheels and that the wheels will not be distorted even though they are not true on their axle.

Another improvement that makes for more rapid operation of the machine is a new traversing speed of 70 inches per minute of the right-hand head along the bed. Also, each pair of axle-journal split bushings, without the use of liners, now takes care of journals ranging from the standard size down

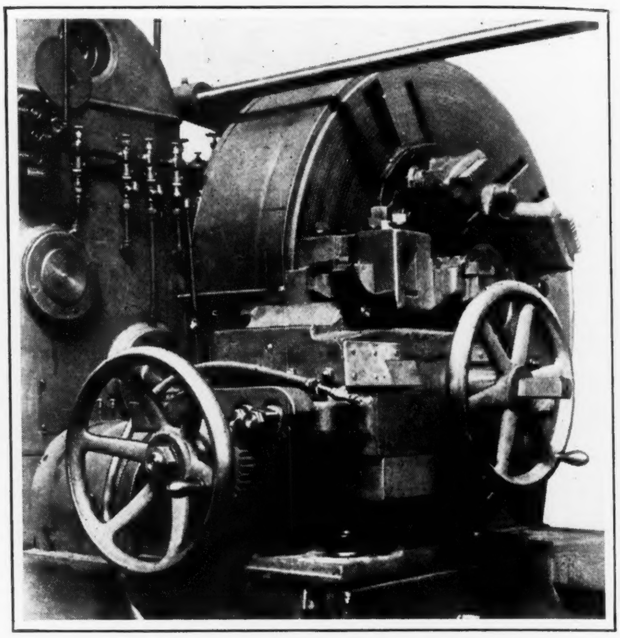


Fig. 3. Improvements Made in Niles Car-wheel Lathe

to those which have reached the A.R.A. wear limit. Other changes in the machine include an improved lubricating system for the right-hand head.

Except for the various improvements to be described, the wheel quartering machine is of the same design as that illustrated in June, 1926, MACHINERY. In the original machine, the ways on the bed were of the inverted V-type, but these have been supplanted by flat tracks which afford more wearing and clamping surface for the heads.

The revolving box-tool crankpin head has a bearing 10 3/4 inches wide, as against 6 inches in the former design. Burnishing rollers are now furnished in addition to the turning tools, the rollers having shanks that fit the tool-holders. For rotating wheels in the central V-supports to bring them into position for quartering or pin turning, screw links having a large handwheel with bosses tapped left- and right-hand to suit the screws which they engage are furnished in place of the original turnbuckle and hooks.

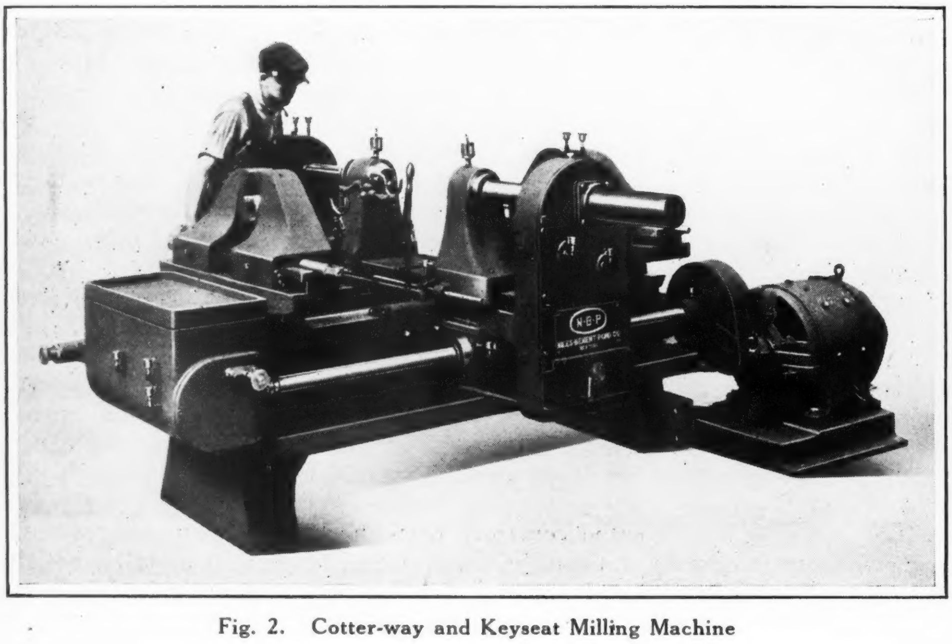


Fig. 2. Cotter-way and Keyseat Milling Machine

The outer screw for elevating and lowering the quartering saddle has been moved further toward the end of the bracket upon which the box-tool head slides and a bearing more than double the former width is provided to support the bracket. This construction eliminates any cramping action during the raising or lowering of the quartering saddle. The shoes that hold the heads to the bed are made in two sections instead of in one piece and insure even clamping. An improvement in the electrical control has been effected by providing a double set of push-buttons

on each head. One of them is located near the wheel set and the other beside the operating handwheels and the speed and feed control levers. Limit switches automatically prevent over-travel of boring-bars in either direction.

The newly designed steam hammer has been brought out in a line ranging in capacity from 3500 to 8000 pounds. It embodies an improved valve and steam passage by means of which it is possible to obtain 30 per cent greater speed of operation than with the former design. Steel forgings and castings have been adopted as far as possible for the main members of the hammer, and the conventional design of the cylinder and frames has been departed from to secure additional strength and a symmetrical appearance.

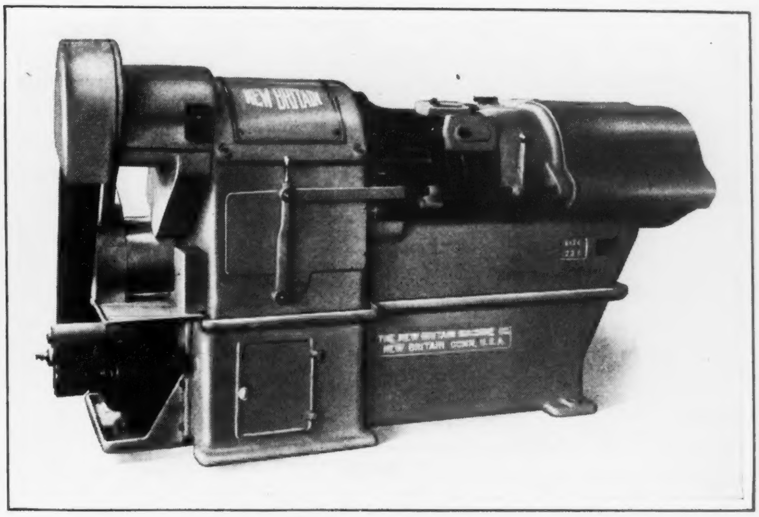


Fig. 1. Front View of New Britain Four-spindle Automatic Chucking Machine

The hammer is of the double-acting type, taking steam both above and below the piston. The length of stroke and the position, speed, and intensity of the blows are controlled either automatically or by hand through two levers. The cylinder is a steel casting, and is fitted with a cast-iron renewable liner. The throttle and operating valve chests are cast integral with the cylinder, and the whole unit is self-draining. A safety cover bolted on top of the cylinder contains two helical springs provided with bumpers which project into the cylinder and act as a cushion. Springs are also furnished on the under side of the cylinder.

Greater depth of frame section and an improved appearance have been attained by eliminating the former curved design and adopting a straight-line profile that blends into a large radius toward the hammer base. The guides are so arranged that they cannot move vertically, but they are free for horizontal adjustment by means of a wedge which can be locked in place. The guides and wedges may be removed without separating the ram from the piston-rod.

NEW BRITAIN AUTOMATIC CHUCKING MACHINE

A new five-station automatic chucking machine known as the No. 23A has been brought out by the New Britain Machine Co., New Britain, Conn. The machine is ordinarily a four-spindle machine, three spindles being used for regular cutting tools and one spindle for threading or reaming in the last position. A fifth spindle, opposite the work loading position, is also provided, to be used when required as a tool-holding spindle. The work-holders or chucks mounted in the turret are only for indexing the work from position to position, while the tool-holding spindles both rotate and feed toward the work.

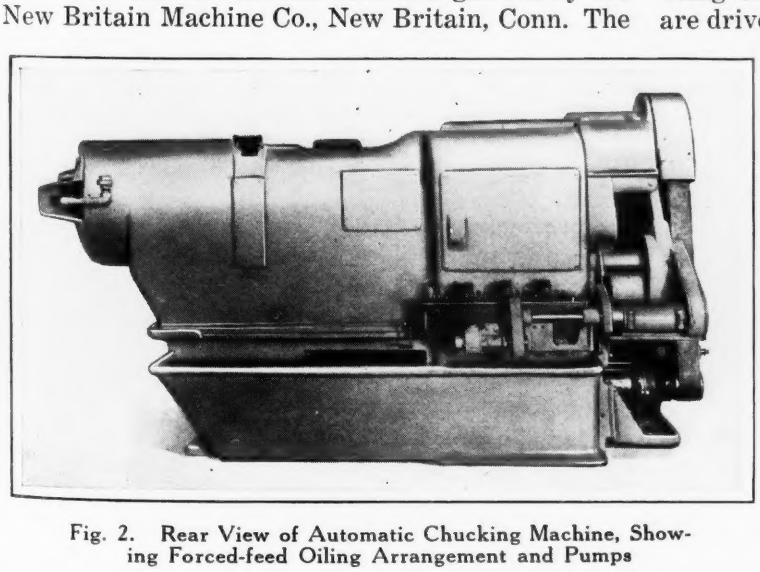


Fig. 2. Rear View of Automatic Chucking Machine, Showing Forced-feed Oiling Arrangement and Pumps

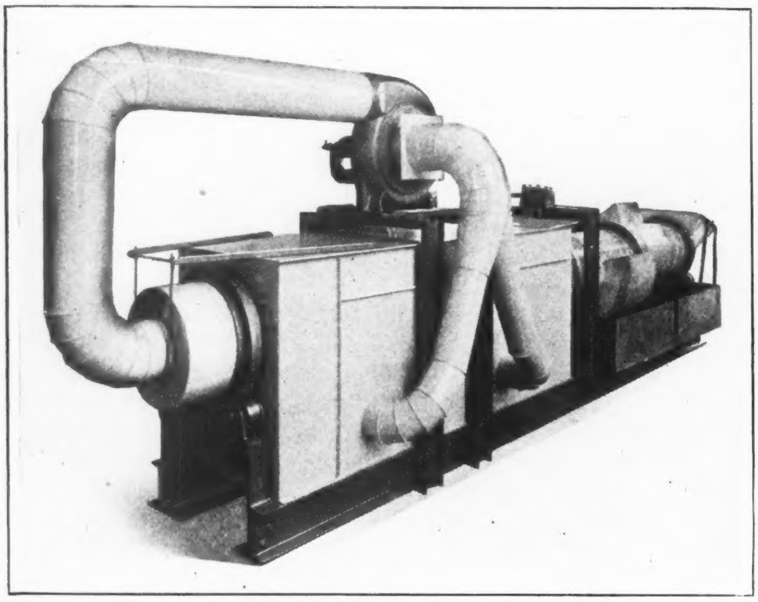
Among the special features of the machine are the unusually high spindle speeds obtainable, ranging from 160 to 1200 revolutions per minute, the higher speeds being those suitable for brass work. These spindle speeds are arranged in four groups, with four speeds in each group, so that each individual spindle may be run at the speed most suitable for the operation it performs. The combination of high and individual spindle speeds permits the work to be performed in the shortest possible time, reducing the idle time to a minimum. The lubrication is also a noteworthy feature, fifty-six different points being oiled by forced-feed lubrication from a Madison-Kipp lubricator mounted at the rear of the machine (see Fig. 2), together with the geared coolant pump.

The extreme range of spindle speeds in any of the speed groups mentioned is 2.7 to 1, the speeds being obtained by change-gears. All the spindles are driven through long-face pinions engaging with gears near the front end of the spindle. The gears are cut on a spiral, the direction of which is such that it tends to pull the spindles from the work. The threading spindle is geared separately from the other spindles so that a greater range of speeds can be obtained. The threading speeds vary from 45 to 700 revolutions per minute, in four groups, the range in any one group being in the ratio of 5.6 to 1. Changing from right- to left-hand threads is effected by shifting gears. The return speed of the threading spindle is always one and one-third times the forward speed. The face of the threading spindle is dropped back 2 1/2 inches from the face of the other spindles to provide space for die-heads.

The spindles are operated by two cam drums; the front cam drum controls the Nos. 1 and 2 spindles, and the second drum operates the Nos. 3 and 4 spindles, including the friction clutches and the leader used for the threading spindle. The fifth spindle, when used, is fed by a hand-lever. Access to the headstock is obtained by removing a plate mounted on the top of the headstock, and other openings in the front and rear provide access to each of the cam drums.

The feed mechanism is almost wholly enclosed in the frame of the machine and is driven by a constant-speed silent chain. There are thirteen feed changes, permitting an output of from 90 to 1250 pieces per hour.

The drive of the machine is through a constant-speed pulley, 14 inches in diameter by 4-inch face, running at 690 revolutions per minute, driven either from a motor below or from a countershaft above. The belt guard over this pulley is adjustable, so that the same guard can be used in either case. One of the advantages of the single pulley drive is that it allows a constant speed for the pumps and the indexing mechanism.



"Autosan" Metal Parts Cleaning Machine

The indexing turret is made in one unit integral with a turret bar which is piloted in the spindle housing. This permits the work to be mounted between two bearings, and eliminates overhang of the work. A large turret cap clamps down on the turret bearing at three points. This cap is automatically released and tightened for the indexing, and an adjustment for it is provided on the outside of the frame. The indexing is operated by an arm and a five-slot Geneva wheel, and requires less than a second. The indexing mechanism is automatically adjusted to the position of the turret by the index arm being mounted on a geared shaft parallel to the axis of the turret. A grooved collar engages with the rim of the turret so that the mechanism is always carried along to any required position. The indexing bolt works in protected slots in the turret, which do not uncover at the forward or the chucking end. The front end of the turret bearing is provided with a ball thrust bearing and has a 5-inch adjustment to or from the spindles.

The work-holding chucks are operated by air or oil. The air or oil cylinders are cast five in a group, without heads; they are placed in a fixed relation to the turret and are not changed when shifting from the collet type of chuck to the screw type. The rear cylinder covers are separate for each cylinder and carry individual valves. A hand-lever for operating these valves is so arranged that the operator's right hand can remain on it constantly for complete control of the chuck when in the loading position. When an ejecting device is used, the operator merely closes the chuck after having put the work in place. When he both removes and replaces work pieces, he opens and closes the chuck by the hand-lever. This hand-lever, when brought to the left, will also stop the feed of the machine. The chuck-operating rack rod is enclosed and protected within the turret enclosure. The chuck jaws have a wide opening, sufficient to handle valve bodies and similar work requiring a grip back of a shoulder.

The machine, when motor-driven, may use up to a 7 1/2-horsepower motor, which is placed on a bracket suspended and partly enclosed in the base, and equipped with an idler pulley for taking up the belt slack. The total weight of the machine is about 7000 pounds, and the floor space occupied, 109 by 33 inches. The total height is 57 inches.

COLT "AUTOSAN" CLEANING MACHINE

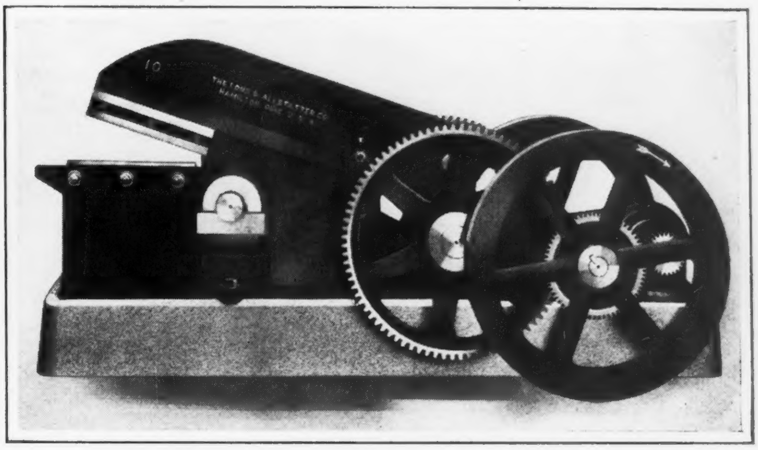
To provide an efficient means for cleaning, rinsing, dipping, and drying nuts, bolts, rivets, screws, stampings, screw machine products, etc., without rehandling, the Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., has brought out the model 28 revolving type "Autosan" metal parts cleaning machine. The construction of this machine is such that it is possible to run many different sizes and types of materials through the machine, one after the other, without mixing the batches. All that is necessary is to permit the revolving cylinder of the machine to make a few revolutions before a new batch is introduced. The work passes from one operation to the next automatically.

In cleaning and rinsing operations, the solution is lifted and poured into the cleaning cylinders without the use of pumps or paddles for applying the solution to the work, scoops of a patented construction being used. These scoops are firmly attached to the outside of the cylinders and insure that the material under treatment is entirely immersed in the solution at all times.

The machines are built with cylinders having diameters of 20 and 30 inches. The former machines will handle most work up to 3 inches in diameter, while the latter will handle much larger pieces. The machines are driven through a speed-reducing mechanism which makes it unnecessary to use countershafts or jack-shafts to obtain the low speeds at which the cylinders are rotated. The driving mechanism may also be direct-connected to an electric motor.

LONG & ALLSTATTER LEVER SHEAR

The accompanying illustration shows a newly designed lever shear recently brought out by the Long & Allstatter Co., Hamilton, Ohio. This machine is of unusual strength, being built completely of steel except for the flywheels, bearings, and tapered liners. It is provided with a safety shearing pin, which can be easily and cheaply replaced, and which insures the main parts of the machine against breakage in case a piece exceeding the capacity of the shear is inserted between the blades.



Long & Allstatter Newly Designed Lever Shear

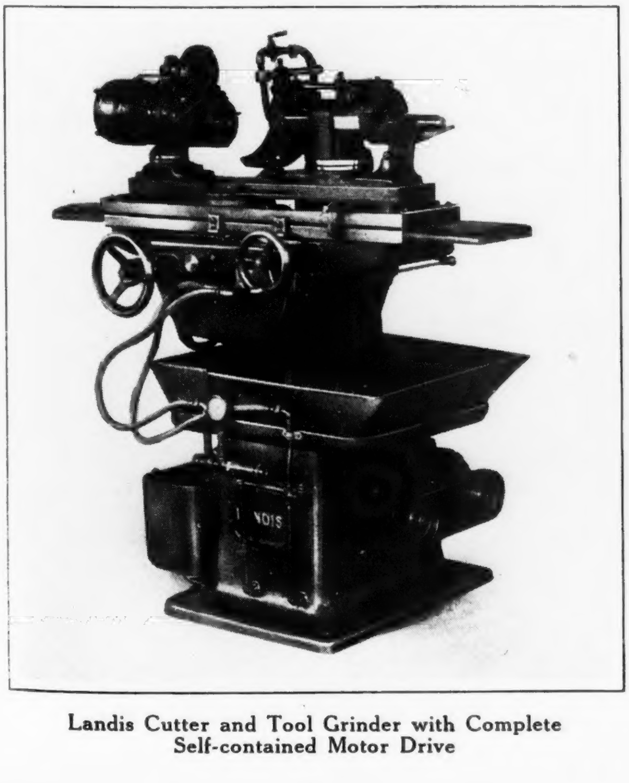
Twin gears are employed on the crankshaft, thereby balancing the load and preventing springing of the crankshaft. The gears are of steel with machine-cut teeth. The accuracy of the cut teeth makes it possible to distribute the load evenly over the gears, and, therefore, the work is not done by one pair of gears only, as is often the case when cast-tooth gears are used. The bearings are bronze-bushed and can therefore be quickly repaired if necessary.

The main lever bearing is also bronze-bushed, and the side thrust developed when shearing is taken by a tapered adjustable gib. With this provision, all lost side motion can be taken up without resorting to the use of shims.

LANDIS CUTTER AND TOOL GRINDERS

The Nos. 11 and 12 tool and cutter grinders built by the Landis Tool Co., Waynesboro, Pa., have been redesigned and arranged for complete self-contained motor drive. Individual motors are used for the main drive and for the work drive, providing a machine with ample power for all classes of work and convenient to operate.

The wheel-spindle and traversing mechanism is driven by a two-horsepower constant-speed motor mounted at the rear of the base of the machine. The power from this motor is transmitted through a double-vee composition rubber belt to a shaft in the base of the machine, and thence to the spindle through a 1 1/4-inch belt passing through the hollow column. A gravity idler pulley maintains uniform tension.



Landis Cutter and Tool Grinder with Complete Self-contained Motor Drive

The headstock is driven by a 1/6-horsepower constant-speed motor which gives, through two belts and reduction pulleys, a speed of 200 revolutions per minute. The motor is so mounted that the full universal features of the headstock are maintained. It can be swiveled 180 degrees in both the vertical and the horizontal plane.

The hydraulic principle, which has been successfully employed on other types of Landis grinders, has been applied on these machines for providing power for the automatic table reverse. The oil reservoir is in the base of the machine, and the oil is pumped from there to the reversing mechanism in the carriage. The oil-pump is driven by a silent chain from the drive shaft in the base of the machine. A traverse speed of from 6 to 360 inches per minute can be obtained. The carriage tarries at the reversal points long enough to permit indexing the work. If desired this feature can be disconnected and the reversal will be automatic. The carriage can also be reversed by hand at any desired point.

The wheel-head has been improved. The tapered bearings have been replaced by larger size cap bearings, which are more easily adjusted and, because of being more substantial, give better support to the grinding wheel. Laminated shims are used under the caps. The bearings are lubricated through a felt wick from a reservoir in the bottom section.

The machine can be operated from the front or from either side of the column in the rear; the control levers and handwheels are all readily accessible from either position. The elevating and cross movement handwheels are graduated in thousandths of an inch.

The redesigned machines retain all the other features of the original Landis tool and cutter grinders. The machines have a longitudinal movement of 17 inches, a cross movement of 9 inches, and a vertical movement of 10 1/2 inches. Work 10 inches in diameter and 20 inches long can be swung on the work centers, and face mills up to 18 inches in diameter can be ground without rais-

ing blocks. The No. 11 machine is for plain work only, and when desired, the hydraulic feed may be omitted and the regular rapid hand feed substituted. The No. 12 machine is for regular universal tool-room work. Complete equipment of fixtures, attachments, and wheels can be furnished for all operations encountered in tool-room work.

BARNES DRILL CO.'S DRILLING AND TAPPING MACHINE

The self-oiling all-geared production drilling and tapping machine here illustrated, which has a capacity for drilling 1 1/2-inch holes in steel, is the latest development of the Barnes Drill Co., 814 Chestnut St., Rockford, Ill. The illustrations show a six-spindle unit. From the end view, Fig. 2, it will be seen that the inclined frame characteristic of previous self-oiling all-geared machines built by this concern has been embodied in the new machine.

Rigidity of construction has been attained by making the heads unusually thick from front to back and by mounting them on a heavy column. The table is also of rigid design, and is provided with slip-block supports directly under each spindle. Each suport consists of three blocks which allow for varying the table height by 3 inches, according to the requirements of work. The table is securely gibbed to four column ways, which practically eliminates table deflection. When preferred, raising screws can be supplied for the table.

Timken tapered roller bearings are provided for all diagonal transmission shafts, the crown pinion, and the crown gear of each unit, while the drive shaft and the cross-spindle shaft run in Fafnir radial ball bearings. The spindle thrust is taken by a Rollway bearing having double staggered rollers.

The quick-change geared feed unit is entirely enclosed inside the main frame, the usual feed-box with its worm and worm-gear being eliminated. Eight quick changes of feed from 0.0055 to 0.062 inch per spindle revolution are regularly furnished through spur gears. Slip gears may be supplied for changing to higher or slower speeds. There are eight quick changes of gear speeds, from 64 to 708 revolutions per minute, and these are obtained through levers extending to the front of the machine. Higher speeds are possible by running the drive shaft faster.

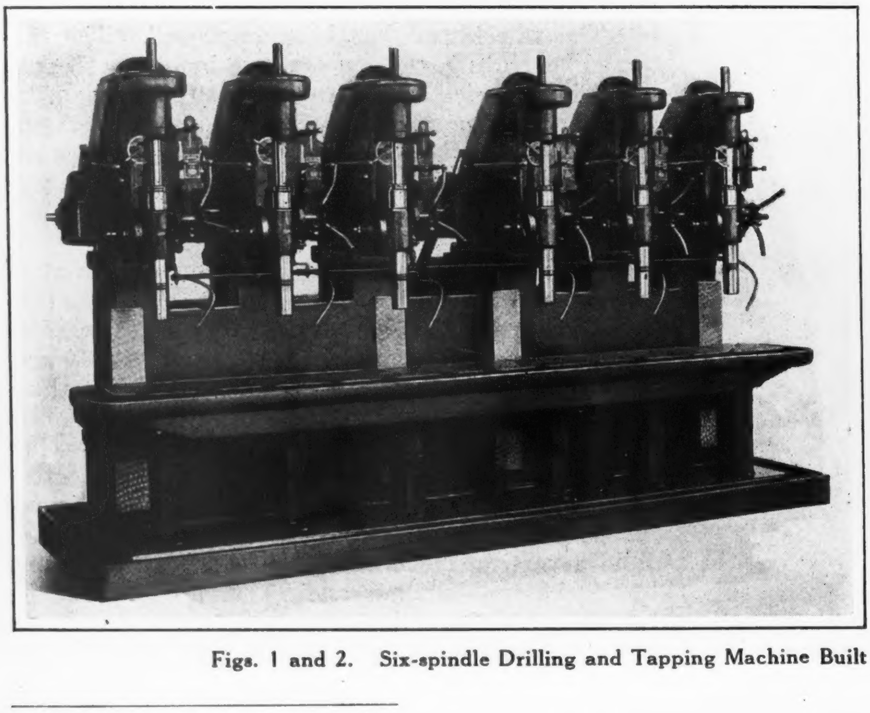
The multiple-disk clutch used for driving each spindle is controlled by a lever on the left-hand side of the respective column. For tapping operations, a reversing multiple-disk clutch and gears are added to the drive shaft. This machine will drill to the center of a 24-inch circle. In drilling through mild steel 2 inches thick with a 1 1/2-inch drill in a recent test, the drilling was performed at the rate of 20.750 inches per minute, with the spindle making 500 revolutions per minute.

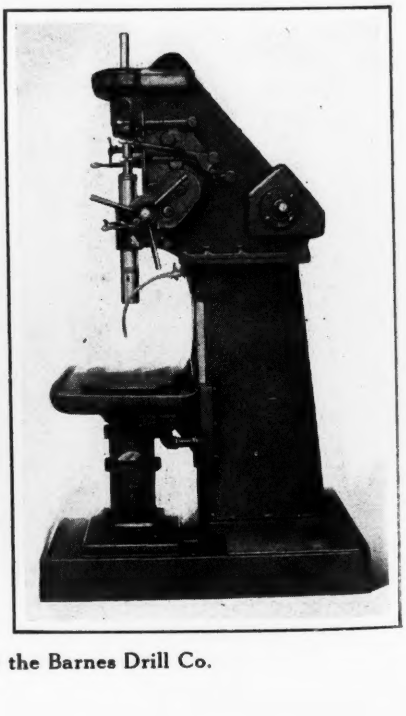
ZEISS UNIVERSAL MEASURING MICROSCOPE

A new Zeiss universal measuring microscope has been placed on the American market by George Scherr Co., Inc., 144 Liberty St., New York City. This microscope is intended for measuring, within the closest possible commercial limits, all dimensions of a screw thread; for checking and measuring thread profiles against dial templets; for measuring dimensions of jigs and gages; and for "spotting" drill jigs.

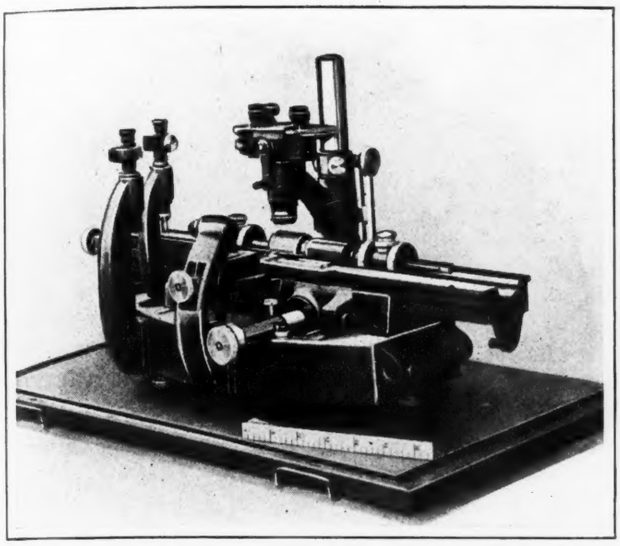
To provide for great precision, no screws are depended upon for measurements, but accurate glass scales, in combination with a novel type of spiral ocular, are used. All measurements are absolute, without reference to standards or gage-blocks. The readings, both for the cross and longitudinal movements, are obtained in a single ocular. The divisions are to one-half of a ten-thousandth of an inch, and the spacings between these divisions are so far apart that the eye can readily subdivide them into hundred-thousandths.

The general construction of the instrument can be seen from the accompanying illustration. On a massive bed, cross carriages are mounted which float in both directions on balls. The two carriages run at exactly right angles to each other. For observing the travel of each, separate microscopes





Figs. 1 and 2. Six-spindle Drilling and Tapping Machine Built by the Barnes Drill Co.



Zeiss Universal Measuring Microscope

are provided. The cross movement serves for measuring the diameters, the longitudinal movement for the lead. Each carriage movement has both coarse and fine adjustment, and the glass scale of each carriage has an independent adjustment. In this way, the scale can be set to zero or to any other convenient figure in the ocular, even after the work has been lined up with the microscope, without thereby disturbing the adjustment.

The universal measuring microscope is furnished with three different types of equipment. In every instance, the basic equipment of bed, cross carriages with centers, glass scales, and spiral microscopes is the same. When intended for a screw thread comparator, the instrument is provided with duplex microscope and knife-edge equipment. When intended as a large toolmaker's microscope, it is provided, in addition to the basic equipment, with a single dial templet microscope, a glass top table platen, and two V-blocks. It may also be provided with a spotting attachment on the microscope bracket. The complete universal measuring microscope incorporates all the available equipment for measuring both by knife-edges and on the glass top table, and includes duplex microscope, V-blocks, and spotting attachment.

The instrument will measure pitch diameters up to 2 inches and leads up to 8 inches. The greatest distance between centers is 28 inches, and the maximum distance under the microscope is 5 inches. Angular divisions of 5 minutes are provided on the protractor eye-piece. The average accuracy of measurements obtainable on this instrument for diameters (using knife-edges) is from $\pm$ 0.00008 to 0.00012 inch. Accuracies between the same limits may also be obtained in measuring lead errors.

INCLINABLE-SPINDLE AUTOMATIC BUFFING MACHINE

In polishing and buffing operations on metal parts, it is frequently desirable to remove marks produced during spinning, drawing, or similar operations. To facilitate the removal of such marks, the Automatic Buffing Machine Co., Chicago and Perry Sts., Buffalo, N. Y., has recently brought out a machine with a work-holding spindle that can be inclined at any angle up to 45 degrees from the horizontal. This design permits the work to be rotated against a buffing or polishing wheel in such a manner that the wheel cuts across the marks, removing all high spots, smoothing down the entire surface, and, finally, buffing it uniformly. This machine is particularly useful for buffing paneled ware, such as coffee percolator bodies, etc.

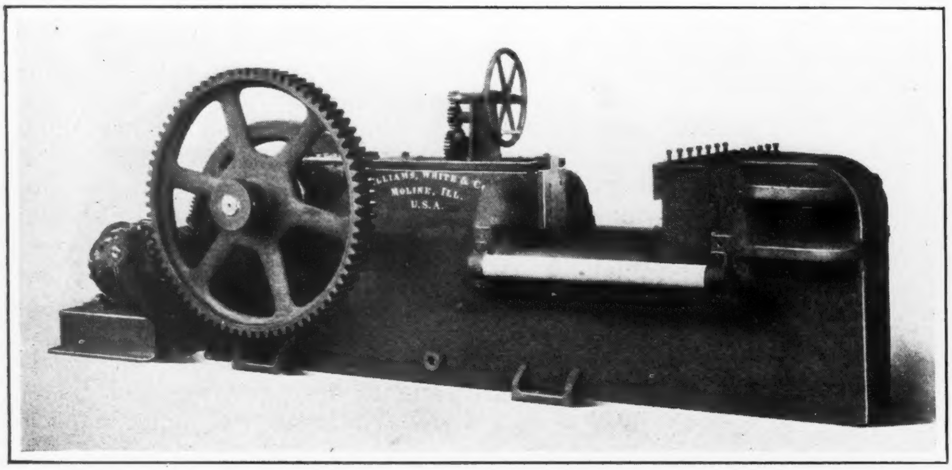
The tilting unit of this machine, known as type 45, has a self-contained drive. Power is delivered by either a 1/4 or a 1/2 horsepower motor, depending on the job, and is transmitted through reduction worm-gearing and bevel gears to the spindle. With a motor speed of 1725 revolutions per minute, the spindle revolves 21 1/2 times per minute. Provision is made for running the worm-gearing constantly in oil. A ball thrust bearing is furnished at the back end of the spindle.

The tilting unit swivels easily on a central bracket, and may be securely clamped in any desired position. It may be set and used with the spindle horizontal, as well as inclined. There is no reciprocating movement of the spindle.

With the exception of the tilting unit, the machine follows closely the construction of the type of machine described in June, 1925, MACHINERY. Two slides at right angles to each other permit the spindle unit to be conveniently positioned by means of lead-screws revolved by handwheels. The spindle unit may also be indexed in a horizontal plane and automatically locked in different positions. The locking plunger is raised from engagement by means of the ball-end handle at the front of the machine.

There is a screw-jack construction in the base to enable the remainder of the machine to be raised so as to position the work-holding chuck properly relative to the buffing wheel. Any type of chuck can be employed. Without chucking equipment, the machine weighs approximately 350 pounds.

Views of the New Automatic Buffing Machine with the Spindle Horizontal and Inclined



Bending and Straightening Machine Built by Williams, White & Co.

HORIZONTAL BENDING AND STRAIGHTENING MACHINES

Two horizontal bending and straightening machines designed primarily for use in railroad and structural shops have recently been added to the line of machines built by Williams, White & Co., Moline, Ill. The No. 2-P bender has a capacity for bending rails up to 110 pounds. The face of the stationary jaw on this machine measures 16 by 45 inches, while the face of the slide is 11 1/4 inches square. The jaw opening is 24 1/2 inches. There is a stroke of 1 3/4 inches and a total adjustment of 8 1/2 inches. The machine requires 7 1/2 horsepower.

The No. 2-A bender, which is here illustrated, has a capacity for bending rails up to 130 pounds and I-beams up to 15 inches in the horizontal plane or 24 inches in the vertical plane. The stationary jaw face of this machine measures 16 by 50 inches and the ram face is 11 1/4 inches square. The jaw opening is 30 1/2 inches. As on the other machine, the stroke is 1 3/4 inches and there is a total adjustment of 8 1/2 inches. About 10 horsepower is required for running this machine.

Both machines can be arranged with either a direct-geared motor drive as illustrated or with a direct-belted motor drive, in which case the motor is mounted on top of the machine. Preference is sometimes expressed for a machine operating continuously without a clutch control, and the bender illustrated is so arranged. However, both machines can be equipped with a clutch control. The side rolls shown in the illustration are in a fixed position, but they can be furnished with a vertical adjustment.

FAFNIR MOLYBDENUM STEEL BALL BEARINGS

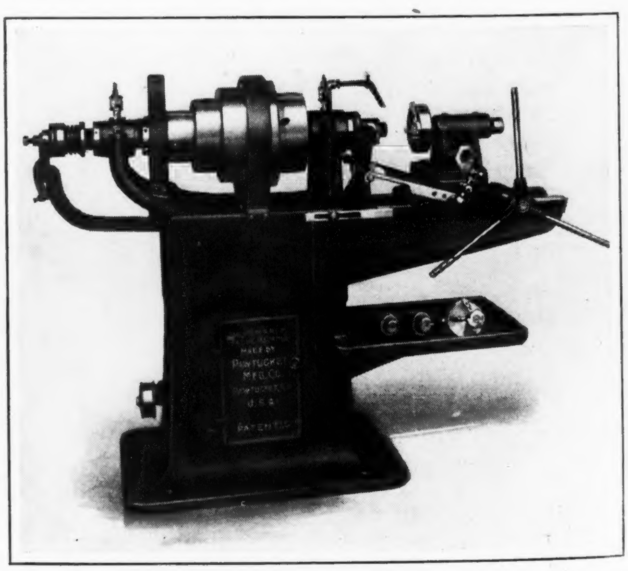
Announcement has been made by the Fafnir Bearing Co., New Britain, Conn., that the company is now furnishing, in all sizes, ball bearings in which both the balls and the bearing rings are made from molybdenum steel. This steel provides greater resistance to wear, fatigue, and shock. The greater uniformity of heat-treated molybdenum steel parts also assures that all bearing parts share equally in the service required of them. At first, molybdenum was used for balls only. It was found that this had a marked effect in increasing the life of the bearing. Later, the use of molybdenum in rings as well as in balls was experimented with, and the results of these tests showed the advisability of using molybdenum steel for the entire ball bearing. At first this material was applied to only a number of sizes, but now the company announces that molybdenum steel is being used exclusively in practically all of the bearings that it manufactures.

VICTOR NUT FACING MACHINE

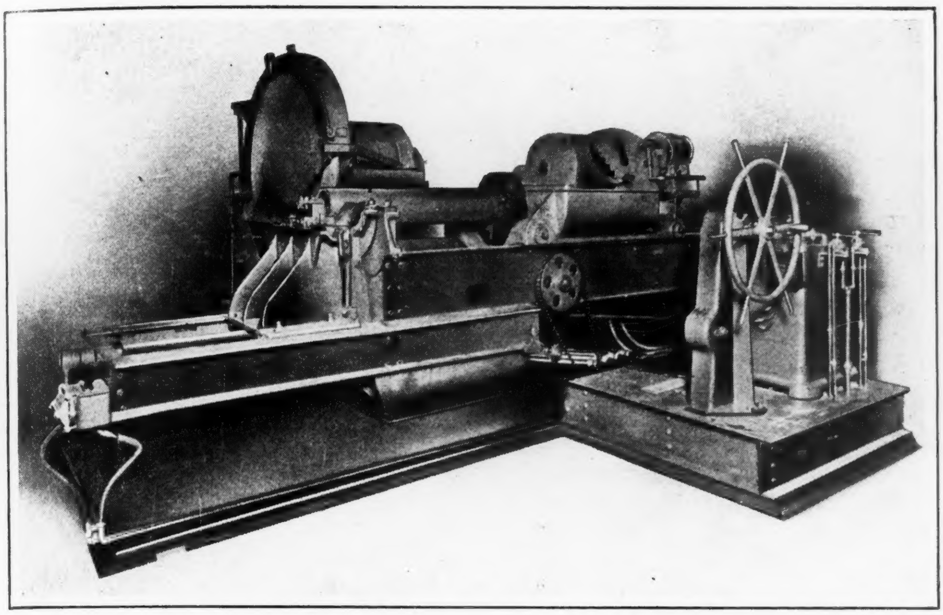
The patterns, patents, and exclusive rights to build and sell the Victor nut facing machines have been acquired by the Pawtucket Mfg. Co., Pawtucket, R. I. This company has now brought out two sizes of these machines with certain improvements in the design, one of the most important of which is that the head has been redesigned so as to eliminate the three-piece cutting tool, one cutter and center burring tool taking the place of the three cutters and burring tool formerly used. The new cutter can be used for both semi-finishing the bottom of the nut and for facing the top of the nut.

One of the important principles kept in mind in designing this machine was to obtain a machine that would face nuts rapidly and true to the thread. The latter object has been attained by facing the nuts on a hardened threaded mandrel fitted with an equalizing collar. It is stated that the average operator can face from 600 to 700 1/2-inch to 3/4-inch nuts per hour and other sizes in proportion.

The machines are made in two sizes, Nos. 1 and 2, the No. 2 machine being the same as the No. 1 with the exception that it is back-geared, and therefore has a capacity for nuts of larger size. The capacity of the No. 1 machine is for nuts from 3/8 to 2 inches, and of the No. 2 machine for nuts from 1 to 3 inches. The No. 1 machine weighs 1300 pounds, and the No. 2 machine, 1400 pounds.



Victor Nut Facing Machine of Improved Design



Ryerson Rotary Attachment for Friction Saws

RYERSON ROTARY ATTACHMENT FOR FRICTION SAWS

A new rotating attachment has been developed by Joseph T. Ryerson & Son, Inc., Chicago, Ill., to be used in connection with either the No. 3 or the No. 4 Ryerson high-speed friction saw. By this means, large pipe as well as round, square, hexagon, and other heavy bar sections can be rapidly cut to the shortest lengths. As an example, in a No. 3 saw, an 8-inch standard pipe is cut off without distortion in twelve seconds.

The attachment consists of a structural framework upon which a carriage for the material travels. A pneumatically operated chuck grips one end of the stock, rotating it by means of a constant-speed motor through a change-gear box. A centerrest, mounted on the work-table of the saw, is arranged to receive bushings for various sizes of material. A sliding gage stop, also located on the work-table, consisting of a heavy casting with screw stop, provides for fine adjustment. Between the steadyrest and the gage stop is a V-shaped support which holds the work while it is being cut and acts as a dumping device for the finished pieces. It is connected to a pneumatic cylinder and is operated from the control stand.

The control stand is located at the right front of the saw, and enables one operator to control all production operations from one position. There are located the levers controlling the saw, the cooling water for the saw blade, the air valves for operating the pneumatic chuck, and a capstan wheel for moving the material forward to the next cut. Controls for starting the motors may also be placed on the stand, if desired. The attachment is built in a number of sizes.

LINCOLN "STABLE-ARC" WELDING ROD

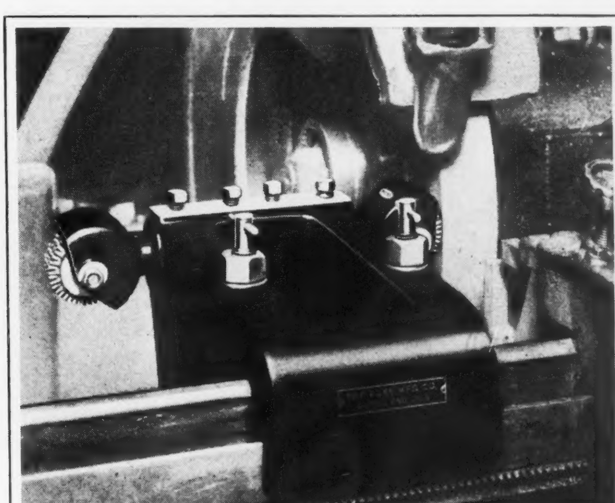
A new line of "dipped" welding rod has been placed on the market by the Lincoln Electric Co., Cleveland, Ohio. This dipped steel rod is the result of several years of research work, and will be known as "Stable-Arc" welding rod. It is a companion to the "Kathode" welding rod which has been furnished by the same company for many years. With the new rod it is possible to use larger diameters than has been customary in welding rods for metal electrode welding in the past. The new rod is carried in all sizes up to 1/2 inch.

It is claimed that this rod permits of much higher currents than have been used heretofore. This will result in greater welding speed, and as labor is by far the greatest factor in welding costs, increased speed means a substantial decrease in costs. Better penetration and a more smoothly finished bead are also claimed for the new rod, and in addition, the greater heat obtainable is said to result in an annealing action, which increases the ductility of the weld and gives greater elongation. The clean finished weld requires less brushing or cleaning between the beads. Current densities of 15,000 amperes or more per square inch can be used. A decrease in "splutter" of the arc is claimed, so that there is less spattered metal, and therefore, more actual metal is deposited per pound of rod.

The new welding rod is obtainable in 50-pound bundles, and in lengths of 14 inches. It can also be secured in longer lengths if desired.

ROSS SIDE-DRESSING FIXTURE

A side-dressing fixture designed especially for Norton grinders, with a view to effecting economies in wheel-truing operations, has recently been developed by the Ross Mfg. Co., Cleveland, Ohio. The fixture, as illustrated, is mounted on the dovetail ways of the grinder table, and is rigidly held by two clamping bolts. Two ball-bearing dressers of the disk wheel type, one for each side of the grinding wheel, are held in the fixture by means of set-



Ross Side-dressing Fixture Designed for Norton Grinders

screws. The dressers are set at an angle of from 3 to 5 degrees, removing, it is stated, from 0.010 to 0.015 inch per cut. New disk sets are obtainable as required, and can be replaced by the wheel operator or in the tool-room.

The fixture may be used either alone or for an operation preliminary to the use of the diamond. In the latter case, about 0.005 inch is left for the final operation. Fixtures are now available for the 10-inch, the 14-inch, and the model 81 Norton grinders. Several models for other grinders will soon be available.

COMBINATION GRINDING AND POLISHING MACHINE

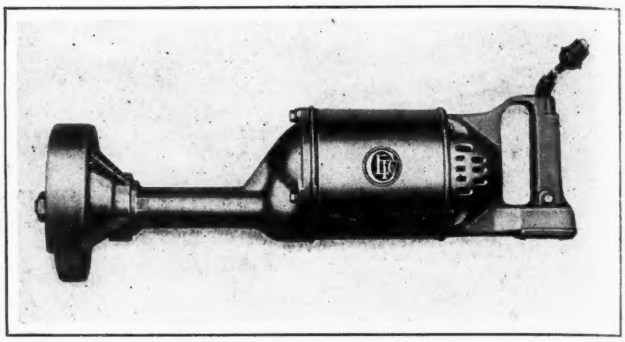
A heavy-duty combination grinding and polishing machine recently placed on the market by the Standard Electrical Tool Co., 1936 W. 8th St., Cincinnati, Ohio, is shown in the accompanying illustration. This machine is built in two sizes, of three- and five-horsepower capacity, respectively. The machine is motor-driven, and is fitted with push-button control. The bearings are encased in dustproof chambers. The armature shaft is made of nickel steel. A device is provided for locking the shaft when changing wheels.

Grinding and Polishing Machine Built by the Standard Electrical Tool Co.

In addition to grinding and buffing wheels, wire wheels or scratch brush wheels can be employed on the machine.

CINCINNATI UNIVERSAL HAND GRINDER AND BUFFER

A universal hand grinder and buffer has recently been brought out by the Cincinnati Electrical Tool Co., 2674 Madison Rd., Cincinnati, Ohio. The new machine is known as the model NSU, and is particularly adapted for foundries, welding shops, garages, and ornamental iron or industrial plants, or in fact, for any location where it is easier to take the tool to the work than to take the work to the tool. The machine is equipped with a 3/4-horsepower motor, and carries a 6-inch by 1-inch grinding wheel, making 3600 revolutions per minute. It is of full ball-bearing construction, both armature and spindle being so mounted. Broad-faced spiral gears, heat-treated and hardened, are used throughout. The armature pinion is removable, being screwed into the armature shaft. All gears run in grease.

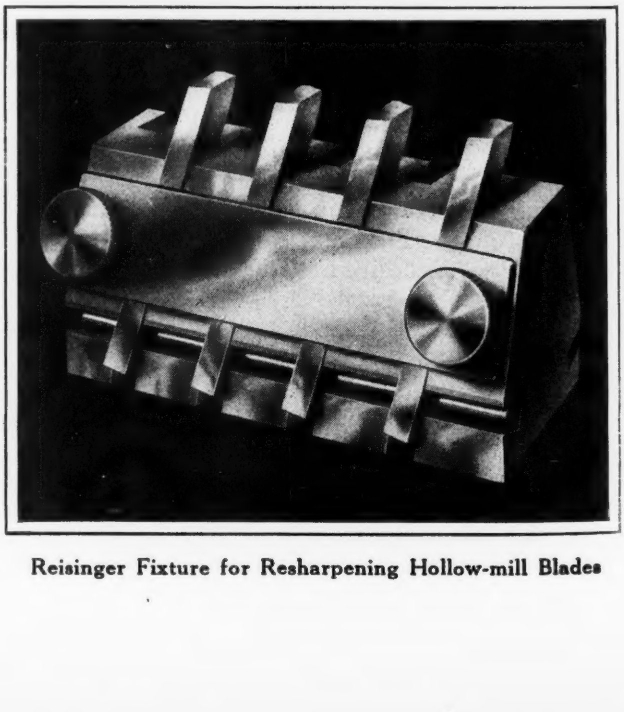


Cincinnati Hand Grinder and Buffer with Universal Motor

The fully enclosed patented switch is located in the handle of the grinder, with a push-trigger under immediate control of the operator. It is of the quick make-and-break type, and may be easily reached by removing four screws. Another new feature is the cable clamp securing the drop cord and its protecting hose against rubbing movement and resulting wear. The wheel guard is adjustable both longitudinally and radially. The weight of the machine is 24 pounds, including wheel and wheel guard. It can be furnished wound for 32, 110, and 220 volts—direct or alternating current.

FIXTURE FOR RESHARPENING HOLLOW-MILL BLADES

A fixture designed to facilitate the resharpening of hollow-mill blades has just been developed by the Reisinger Machine Tool Corporation, 839 Lake Ave., Rochester, N. Y. This fixture is so designed that blades can be ground for cutting steel on one side and brass on the other. The blades are simply inserted in the slots, of which there are four on each side of the fixture, and are then clamped as shown. The blades can all be ground to even length on a surface grinder.

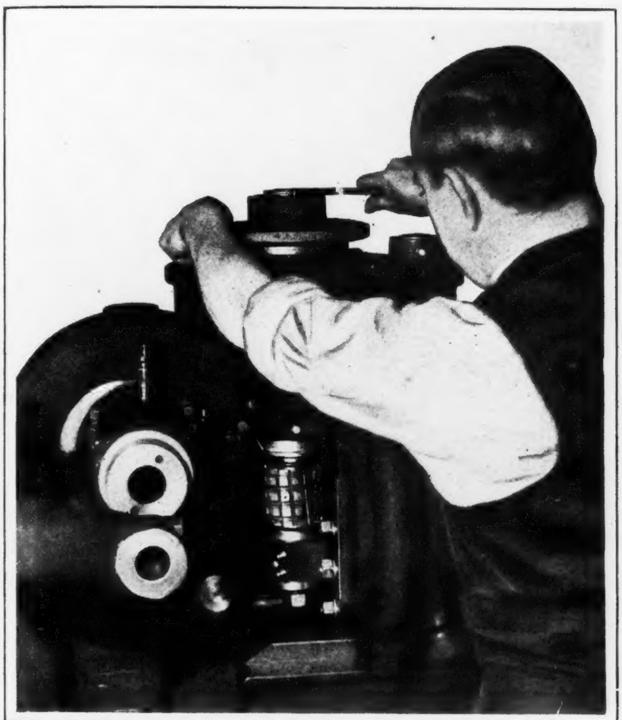


Reisinger Fixture for Resharpening Hollow-mill Blades

LEES-BRADNER ADJUSTABLE HOB SPINDLE

A micrometer adjustable hob spindle has recently been developed by the Lees-Bradner Co., Cleveland, Ohio, for the No. 5AC gear generator described in April MACHINERY. The machine may be furnished with this new spindle or with the plain head illustrated in the article referred to. With the micrometer adjustable spindle, the hob may be conveniently shifted in thousandths of an inch.

In the accompanying illustration, the operator is shown releasing the clamp nut at the top with his right hand and shifting the hob by means of the micrometer adjustment with his left hand. The clamps that hold the outer support of the hob arbor just below the hob were previously released to allow a slight change in hob position. After an adjustment has been made, these clamps and also the clamp nut at the top are again tightened. The micrometer dial is seen just below the flange of the



Adjusting the Micrometer Hob Spindle of a Lees-Bradner Gear Generator

adjusting handwheel. Another feature of the new hob spindle is that it can be withdrawn for quickly removing a hob, without altering any other setting of the machine.

MILLHOLLAND AUTOMATIC UNIT DRILL HEAD

Opinion is divided among users of machine tools concerning the relative merits of standard machinery and equipment designed for the performance of specific operations. Each class has its advantages, but unless the special machine is built to pay for itself in a comparatively short time, the increased production obtained through its use is likely to be more than offset by the cost of discarding the machine due to a change in the design of the work. With a view to combining advantages of both standard and special machinery in a single unit, the Millholland Sales & Engineering Co., Indianapolis, Ind., has developed what is known as an

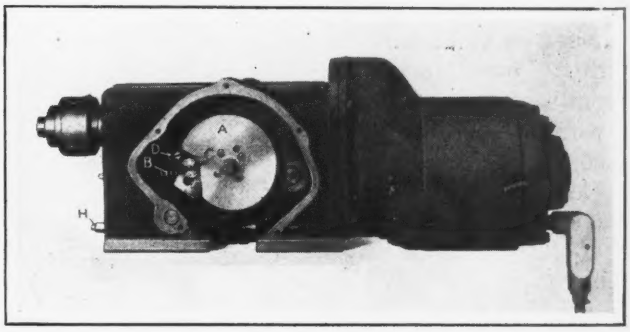


Fig. 1. Automatic Unit Drill Head with Motor Drive

"automatic unit drill head." This name is employed to differentiate the equipment from the well-known multiple-spindle drill heads used as auxiliary equipment on standard types of drilling machines. The company designs and builds machines equipped with unit heads to meet the requirements of the work.

This head may be used for a wide range of operations, such as drilling, reaming, counterboring, spot-facing and hollow-milling. It is made in three sizes, and may be equipped with a one-, two- or three-horsepower motor or with a belt drive. Provision is made for adding a motor drive to the belt-driven head at any time. When one or more heads are mounted on a special bed for a given piece of work, the equipment possesses the productive capacity of a machine especially designed for the work, but should it be required to discard the equipment, due to a change in the product, only the bed is lost, as the heads can be rearranged on a new bed for other work.

From Fig. 1 it will be seen that the motor is mounted in a housing bolted to a flange at the end of the drill head casting, the necessary reduction of speed being obtained through spur gears which transmit the drive to the spindle. As the equipment is used on repetitive work, no provision need be made for quick changes of speed. The necessary rotation for the most efficient performance of a given operation is obtained by providing gears of the proper ratio. All the mechanism is enclosed in a dustproof housing, although the illustrations show the head with the covers removed.

The nature of the work determines whether the head shall run continuously or go through a cycle of operations and then stop. Cam *A* provides for rapidly advancing the tool to the work, feeding it into the work at the desired rate, and rapidly returning it to the starting point after the operation has been completed. This cam is laid out to meet the requirements of the job. Coil spring *B* holds

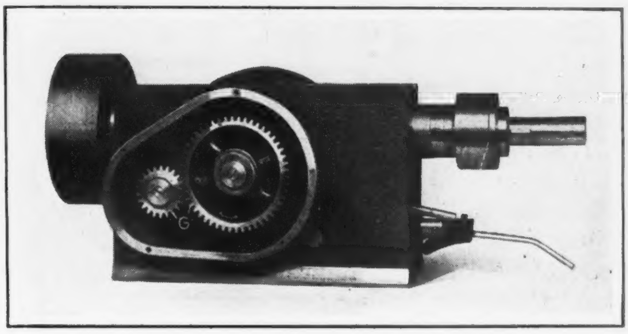


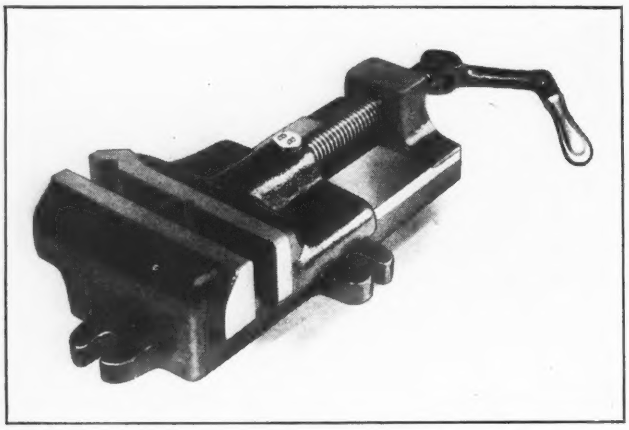
Fig. 2. Opposite Side of a Belt-driven Head

roller C in contact with the cam, and this roller is carried by a link connected to yoke D on the spindle quill. Power for driving the feed cam is taken from a worm on the spindle and delivered through a worm-wheel to a pair of spur gears G, Fig. 2, the second of which is mounted on the camshaft.

Continuous operation or tripping by hand at the start of each cycle is obtainable by means of a positive clutch carried by the first spur gear. When plunger H is pushed in, a wedge mechanism engages the clutch, the latter being normally kept disengaged by a coil spring. For continuous operation, the plunger is kept pushed in, whereas for intermittent operation, a suitable lever is provided for pushing in the plunger and, at the end of each cycle, a knock-out on the feed cam withdraws the plunger and releases the clutch. The time required for performing a given operation is calculated, and the cycle is then timed to meet conditions.

BROWN BROS. MACHINE VISE

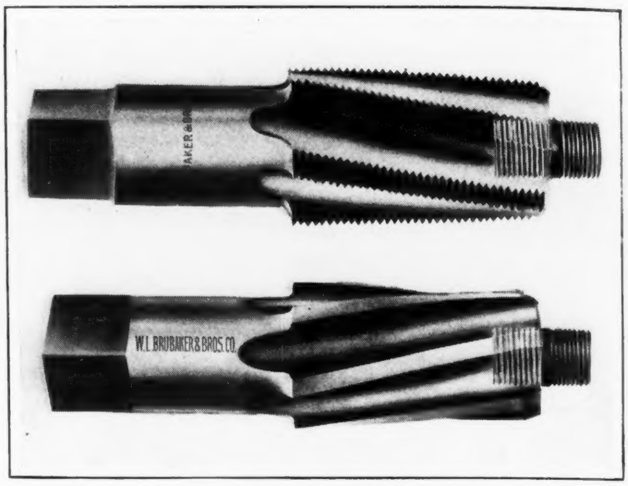
An improved machine vise now manufactured by the Brown Bros. Machine Co., 815 E. 93rd St., Cleveland, Ohio, is shown in the accompanying illustration. To facilitate difficult set-ups on machines, such as bolting the vise vertically on an angle-plate, the top, bottom, and sides of the vise are machined after assembling. The vise has a pair of accurately milled V-slots that are vertical with the jaws, and there is 1 1/4 inches of overhang, which permits handling a variety of work that must hang below the machine table. The outer V-slot is approximately in the center of the overhang, so that round bars up to 1 inch in diameter and 3 or 4 feet long can be easily held for machining across the ends. The vise has an over-all length of 17 1/2 inches, an over-all width of 7 inches, and a jaw opening of 4 inches. It weighs about 25 pounds.



Improved Machine Vise Made by Brown Bros.

BRUBAKER STAYBOLT TAPS AND REAMERS

In order to increase the life of flexible staybolt taps and reamers, the W. L. Brubaker & Bros. Co., 50 Church St., New York City, are making these taps and reamers according to a new design, as illustrated. Instead of making the pilot screw a solid part of the tool, these taps and reamers are made with a threaded hole in which is inserted an unhardened adapter stud, with its outer end threaded with a standard pipe thread for use with the usual extension.



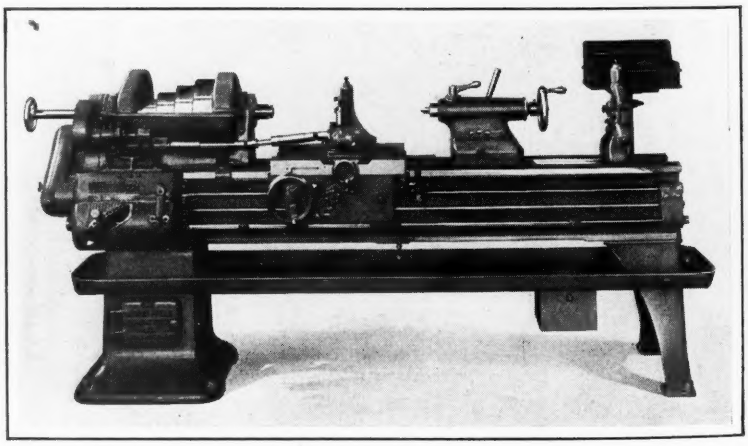
Flexible Staybolt Tap and Reamer of New Design

The advantages of this design are that the unhardened pilot screws are not brittle, and consequently are less likely to break than those hardened with the tool; in case of breakage and stripping of the threads of the stud, the adapter is quickly removed and a new one inserted, thus prolonging the life of the tool; and furthermore, the same tools may be used with an extension having either an inside or outside thread.

SPRINGFIELD TOOL-ROOM LATHE

A 16-inch by 8-foot precision tool-room lathe equipped with a four-step cone and single back-gears has recently been added to the line of lathes built by the Springfield Machine Tool Co., 631 Southern Ave., Springfield, Ohio. This machine is provided with a rapid change-gear device that gives thirty-six changes of threads and feeds. A reversing mechanism for the apron gives right- and left-hand threads and feeds, and there is an automatic stop for each direction.

The machine is equipped with a relieving attachment, taper attachment, draw-in collet attachment, full set of collets, oil-pan, tool cabinet, and quick-acting tailstock, as well as the regular equipment of steady and follow rests, large and small face-plates, double friction countershaft, and wrenches.

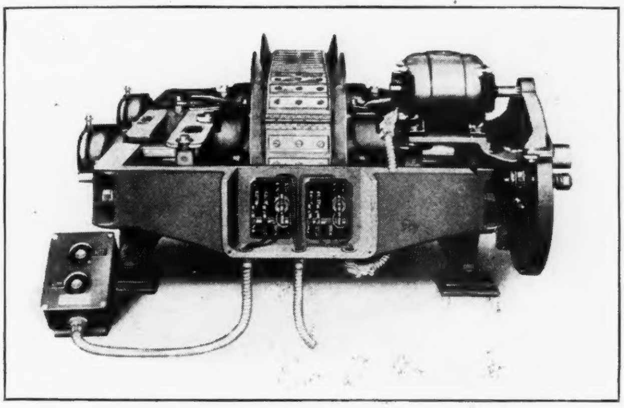


Springfield Tool-room Lathe

REEVES ELECTRICAL REMOTE CONTROL

An electrical remote control has recently been brought out by the Reeves Pulley Co., Columbus, Ind., for application to the variable-speed transmission made by that concern. This control may be furnished in place of the standard hand control to make it possible for the operator to regulate the speeds from any position or from a number of positions, no matter how remote from the transmission itself. Thus, the remote control is of particular value in connection with machines or equipment of considerable length, such as material-handling conveyors, where the operator is often at some distance from the transmission itself.

This remote control consists of a fractional-horsepower reversible motor, mounted on a bracket above the shifting screw of the transmission and connected to this screw by single-reduction spur gears. The motor is started in either direction by one or more push-button stations operating through a magnetic switch. The switch is placed in a receptacle cast in the frame end of the transmission, as shown in the illustration. It is universal as to current characteristics, and hence a transformer is never necessary. Since the motor is of fractional-horsepower size for transmissions up to and including No. 7, it is generally possible to use the regular lighting circuit, although any circuit can be used.

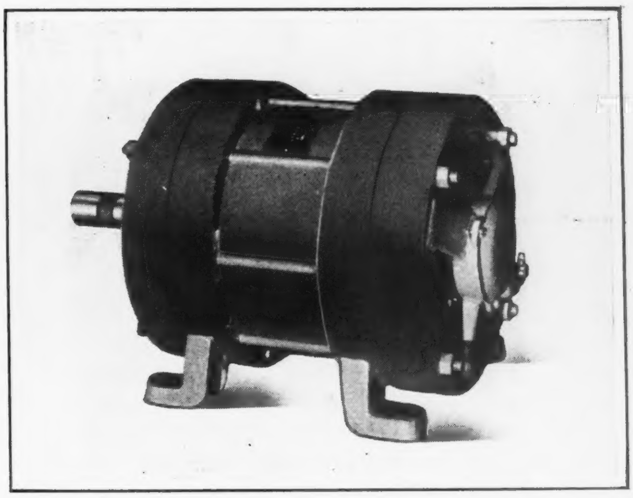


Reeves Variable-speed Transmission Equipped with Electrical Remote Control

For protection in case an operator should hold a push-button beyond the slow or fast limits of speed, a patented safety clutch prevents jamming of the motor or the transmission. This remote control is entirely self-contained, compact, positive in action, and accessible for any necessary minor adjustments.

LINCOLN ALL-STEEL BALL-BEARINC MOTORS

A complete line of all-steel ball-bearing polyphase induction motors ranging in size from 1 to 100 horsepower in all standard voltages and cycles is being placed on the market by the Lincoln Electric Co., Cleveland, Ohio. These motors are representative of the new types of equipment being brought out by the concern mentioned, in which gray iron and malleable-iron castings have been entirely replaced by hot-rolled steel.

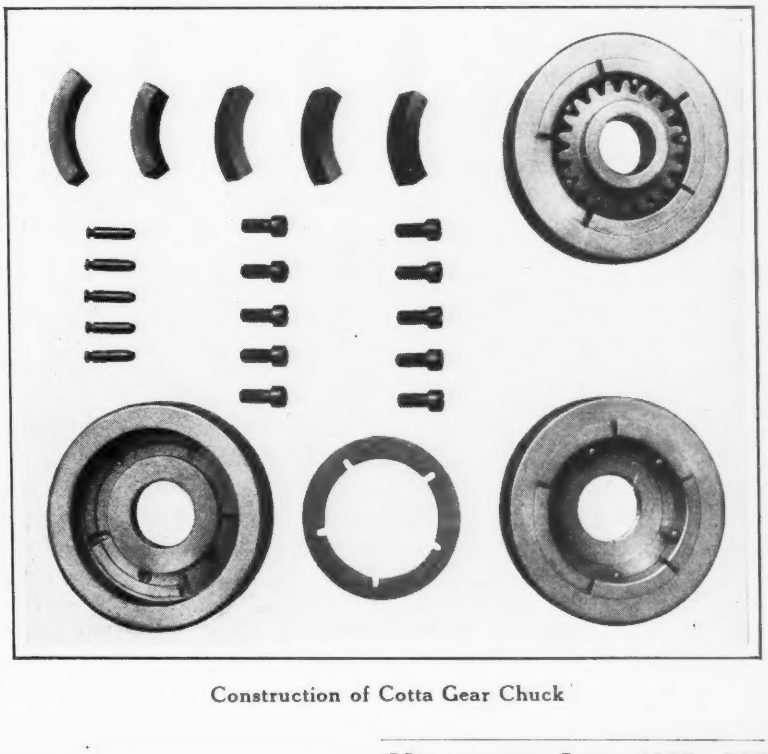


Lincoln Motor of All-steel Ball-bearing Construction

It is claimed that every part of the motors is at least twice as strong as in the former type, which was built with a cast-iron frame. Drop-forged steel feet are welded to the steel end rings, thus, it is claimed, eliminating breakage of feet due to rough handling. The end brackets or bearing supports are also made up of welded steel. Owing to the greater strength of steel as compared with cast iron, less thickness of metal is required in the frame. The increased ventilation thus made possible is said to result in a considerable increase in the overload capacities of the motors, so that a continuous overload of from 10 to 50 per cent, depending upon the size and speed, can be handled by the motors.

COTTA GEAR CHUCK

A chuck designed for holding gears at the pitch line to permit boring, reaming, or grinding them concentrically with the pitch circle is being placed on the market by the Cotta Gear Co., Rockford, Ill. From the illustration it will be seen that the chuck



Construction of Cotta Gear Chuck

has a cast-iron body to which cam segments are secured by means of screws. These cam segments are ground eccentrically, and each segment is located in the same relation to the center of the chuck and in the correct relation to locating rollers. To chuck a gear, it is merely inserted in the chuck and given a slight turn to the right or in the directions of the working pressure. This automatically centers the gear and holds it rigidly. Any crowding or additional strain caused by the pressure of the grinding wheel or boring and reaming tools tends to increase the gripping pressure.

The number of cam segments and locating rollers depends upon the pitch diameter and the number of teeth in the gear to be chucked. As the pitch diameter and number of teeth increase, the number of segments and locating rollers is increased to insure equalizing any irregularities that may exist in the gear. The cam segments and locating rollers are made of tool steel, hardened and ground to the correct diameter for the pitch of the gear. They are located in a carrier which spaces them in the proper relation to the gear teeth.

The carrier ring is notched to be a free fit in the grooves near the base of the locating rollers, permitting the rollers to turn freely and thus insure longer life. The carrier also moves freely between stop pins set at a distance sufficient to let the rollers travel the entire rise of the cam segments. The chuck is designed to be mounted on a simple chuck-back or adapter, so it can be used on any machine.

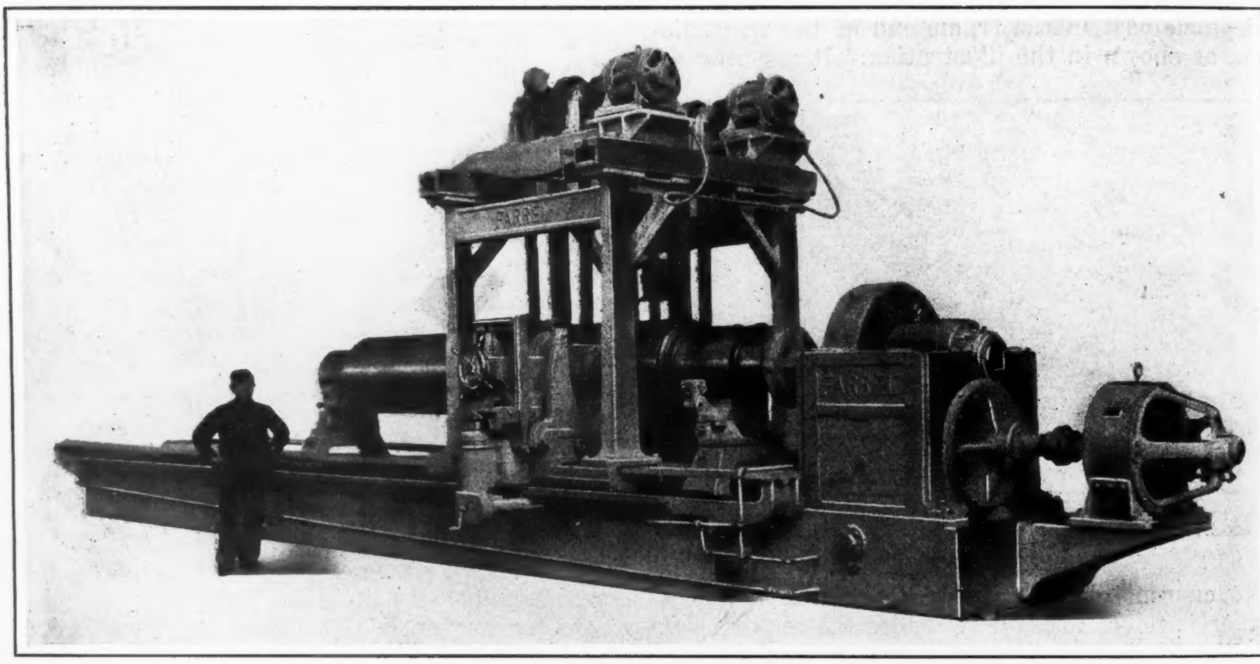
BOTFIELD "ADAMANT" GUN

A device known as the "Adamant" gun has been developed by the Botfield Refractories Co., Swanson and Clymer Sts., Philadelphia, Pa., for the purpose of maintaining furnace linings in a condition approximating their newly built state. In connection with the "Adamant" gun, a chemically neutral refractory material known as "Adachrome" and "Adamant" fire-brick cement are used. The "Adamant" gun is employed for blowing protective coatings on the brick work in the form of "Adachrome" or other refractory materials, employing "Adamant" cement as a binder. The device weighs less than 4 pounds and requires only one man to operate it. It uses air or steam at 50 pounds pressure per square inch. As air gives the most satisfactory results, it should be used whenever possible.

FARREL TWO-WHEEL ROLL GRINDER

A two-wheel machine designed for the quick and accurate grinding of rolls not over 36 inches in diameter, which is provided with a device by means of which crowns can be ground without any cut-and-try method, has recently been built by the Farrel Foundry & Machine Co., Ansonia, Conn. In addition to being accurate, the crowning device can be set in a few moments.

In making a setting, the carriage is run to the center of the roll, two nuts are loosened, and a scale is turned to the desired amount of crown. The nuts are then retightened, a clutch engaged, and the crowning operation is started. As the wheels move to and from the center of the roll the crown is produced. Concave surfaces can also be ground with this device, and if straight grinding is desired, the entire crowning device is disengaged by operating a clutch.

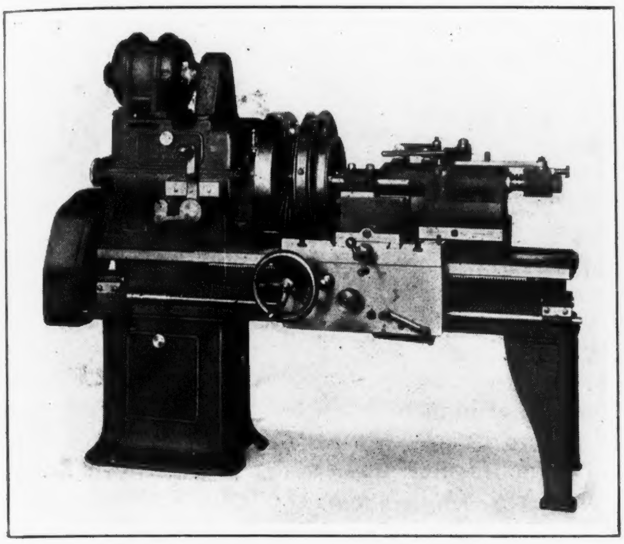


Farrel Two-wheel Roll Grinding Machine Equipped with a Crowning Device

The grinding is performed by two wheels which act on opposite sides of the roll. Each wheel is 20 inches in diameter, has a 2-inch face, and is driven by a Westinghouse 7 1/2-horsepower motor. The driving head is direct-connected to a Westinghouse 25-horsepower motor, is completely enclosed, and is provided with flood lubrication. Automatic lubrication is also furnished for the ways, feed-screw, and head.

BRADFORD RAPID TURNING LATHE

A lathe of 22 inches swing, possessing features that adapt it for the rapid performance of turning operations, is a recent development of the Bradford



Bradford Lathe Arranged for Turning Brake-drums

Machine Tool Co., Eighth and Evans Sts., Cincinnati, Ohio. In the accompanying illustration, this machine is shown equipped for turning brake-drums in a floor-to-floor time of two minutes.

On the cutting movement, the carriage is automatically stopped when it comes against a collar on the feed-rod. This collar is adjustable along the rod, so that the travel of the carriage can be regulated to suit the length of the work. A positive adjustable diameter stop is provided on the carriage bridge, and there is a quick hand return for the carriage. When the lever shown on the front of the head is moved into the inoperative position, a mechanical friction brake is automatically applied direct to the spindle to stop the work quickly.

The work-arbor is seated in the end of the tailstock spindle, the pilot end of this arbor being equipped with a ball bearing which takes the thrust caused by the heavy spring-back of the tailstock spindle as the spindle is advanced against the work. The horizontal lever on top of the tailstock is used both to advance the tailstock spindle and to lock it at the end of the forward movement. The spring permits the pressure in back of the arbor to be adjusted so as to hold the work firmly and yet not cause undue end thrust between the contacting parts.

A sliding shoe which is dovetailed into the top of the rear spring block permits the whole tailstock spindle, including the rear spring block, to be advanced toward the work without releasing the tailstock holding bolts and without altering the spring pressure. Quick release and recession of the tailstock spindle is also effected by means of the horizontal lever on top of the tailstock. This lathe can be provided with a power rapid traverse for the carriage when it is to be used for turning long work held between centers.

MORTON HEAVY-DUTY DRAW-CUT SHAPER

A heavy-duty pillar type of draw-cut shaper that has many of the same features of design as the heavy-duty railroad shaper described in April MACHINERY is being introduced to the trade by the Morton Mfg. Co., Muskegon Heights, Mich. However, the railroad shaper contains a rotating arbor inside the ram for machining circular work, while the pillar shaper does not possess this feature.

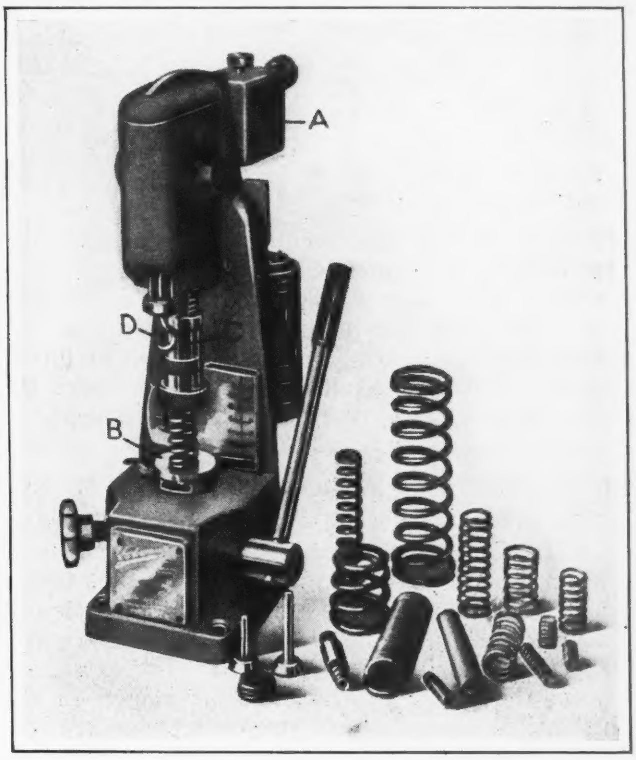
The new shaper also has a cutting stroke of 36 inches, a vertical feed of 21 inches, and a horizontal feed of 48 inches on the cross-rail. The cross-rail can be extended so as to give a horizontal feed of 56 inches if desired. All feeds are obtained automatically, and they can be changed while the machine is in operation. The cross-rail is raised and lowered by means of three adjustable screws. Clutches and other important parts are automatically oiled, and all bearings are made of bronze. An adjustable back bearing transfers cutting strains to the column.

The new shaper will take the various attachments for railroad work, with the exception of that used in slotting driving boxes, and it is equipped with an auxiliary table, large T-slotted table, swivel base vise, jib crane with a two-speed hoist, and a set of O. K. tools and holders. The machine can be furnished with either belt or motor drive. It can also be built with a cutting stroke of 48 inches and a horizontal feed of 56 inches on the cross-rail.

"ELASTICOMETER"

A spring testing device known as the "Elasticometer" is being introduced on the United States market by the Coats Machine Tool Co., Inc., 112 W. 40th St., New York City. This device is intended for testing the elongation and compression of springs. It can be furnished for reading in pounds and inches or in accordance with the metric system of weights and measurement.

The "Elasticometer" is essentially a precision beam balance having a ratio of 10 to 1. It is composed of three units—levers, connecting links, and a main body. There are four levers, one each for compression, tension, weight, and balance, and these are connected with one another through knife-edges and links. Linked to the compression lever is a fork carrying a sleeve having a square



"Elasticometer" for Testing Springs

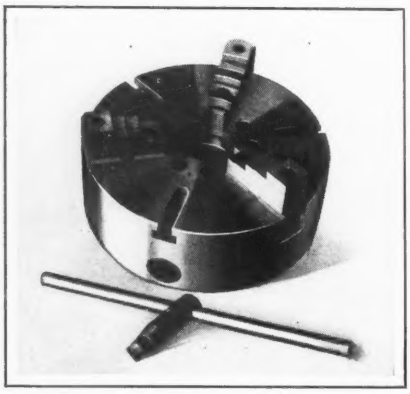
thread. A pressure transmitting spindle consisting of three sections which can be screwed conjointly or separately to accommodate various lengths of springs is screwed into the sleeve and used for testing compression springs. The transmission lever carries weights used for the various tests. The balancing lever carries a weight *A* which may be closely adjusted on a horizontal beam to balance the scale before starting tests. An indicator for controlling this operation is connected to the lever system.

For a compression test, the spring is placed between the pressure transmitting spindle *C* and anvil *B*, as shown in the illustration. For an elongation test the spring is suspended between hook *D* and the hook of anvil *B*. A double graduated scale mounted on the front of the body, in conjunction with a movable indicating bar, gives the results of tests.

Compression springs from 1/4 to 8 1/2 inches in length can be tested, and tension springs from 1/4 to 8 inches in length. The base of the device measures 5 by 7 inches, and the total weight is about 50 pounds.

SKINNER EXTRA HEAVY SCROLL CHUCKS

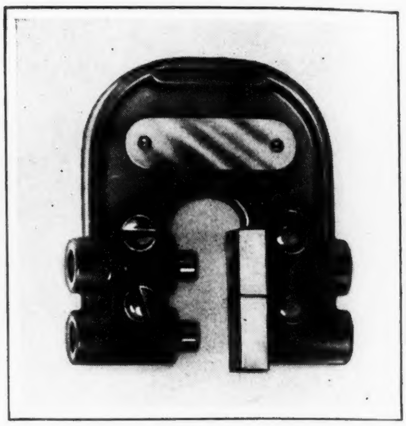
In order to meet the demand for a heavy-duty universal geared scroll chuck for use on turret lathes, the Skinner Chuck Co., New Britain, Conn., has brought out a line of extra heavy chucks, one of which is shown in the accompanying illustration. Not only is the chuck of much heavier dimensions than formerly used for this purpose and provided with an all-steel body, but the pinion and geared scroll are both made from alloy steel and heat-treated, producing an unusually strong combination. In bringing out this line of chucks, the company has kept in mind the principle that, in selecting a chuck for the modern high-powered turret lathe, the first cost is not the most important consideration, but rather, the selection of a chuck that will give continuous service and avoid loss of production of the turret lathe because of breakdowns of chucks.



Heavy-duty Universal Geared Scroll Chuck for Use on Turret Lathes

GREENFIELD INSPECTION LIMIT SNAP GAGES

The Greenfield Tap & Die Corporation, Greenfield, Mass., has recently added a new rapid inspection limit snap gage known as the No. 1616 to the line of gages made by the company. The particular feature of the new line of gages that makes rapid inspection possible is the solid jaw extending beyond the frame of the gage, as shown in the illustration, upon which projecting surface the work can be properly located and held level before moving it toward the actual measuring anvils. The method of adjusting and locking the anvils has been greatly improved and simplified. Each anvil may be adjusted and locked without disturbing the others. Ten different frame sizes are provided for handling work up to 6 inches in diameter.

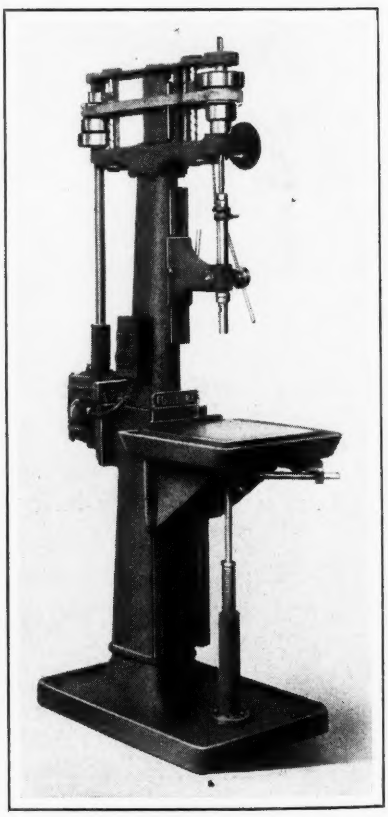


Limit Snap Gage Designed to Permit Rapid Inspection

MOTOR DRIVE FOR "FOOTBURT SIPP" DRILLING MACHINE

After experimenting with various types of motor drives, the Foote-Burt Co., Cleveland, Ohio, has finally adopted the motor drive here illustrated for the largest "Footburt Sipp" sensitive drilling machine. This machine has a capacity for drilling holes up to 7/8 inch in diameter in cast iron. No gears are used in the drive, a constant-speed motor being connected direct to a vertical drive shaft on which a four-step cone pulley is mounted. The drive is then transmitted by an endless belt to a cone pulley mounted directly on the spindle. Four speeds of 544, 870, 1360, and 2180 revolutions per minute, respectively, may be obtained with this arrangement. It is possible to change quickly from one speed to another by turning the speed-change lever.

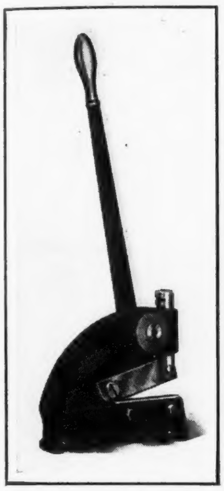
The automatic idler pulleys used on previous machines have been retained in this model to keep the belt tight and pulling to capacity at all times, thus producing a smooth steady drive. Another advantage of the new drive is the possibility of keeping the center-to-center distance between the spindles of multiple-spindle machines down to 8 inches, by staggering the mountings at the back of the machine. This would be impossible with motors mounted directly on the spindles, because of the diameter of the motors themselves.



"Footburt Sipp" Drilling Machine with New Motor Drive

The motor used is of 3/4 horsepower capacity, and runs at 1800 revolutions per minute. It is a standard vertical motor of the completely enclosed type, which eliminates the possibility of dirt getting into the armature and fields. This new type of motor mounting can be applied to any number of spindles up to eight.

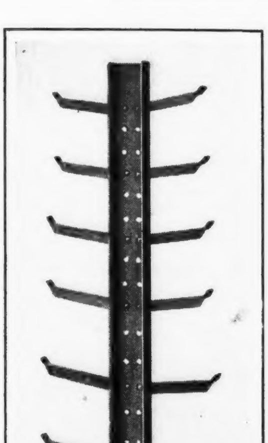
BUFFALO SLITTING SHEAR



Buffalo Slitting Shear

A small-sized slitting shear for which compactness, light weight, and convenience of operation are claimed has recently been added to the products of the Buffalo Forge Co., 144 Mortimer St., Buffalo, N. Y. Although this slitting shear easily cuts No. 14 gage plates, taking 1 3/4 inches of material at a stroke, it is only 6 inches long by 5 1/4 inches high, exclusive of the handle, and weighs about 5 pounds. Flat bars measuring 3/4 by 1/8 inch can be sheared at one stroke. The body of the device is a drop-forging.

POLLARD BAR STOCK RACK



Pollard Steel Rack for Bar Stock

The arms of the bar stock racks now manufactured by the Pollard Bros. Mfg. Co., Inc., 4035 N. Tripp Ave., Chicago, Ill., may be adjustably spaced on the columns to meet requirements. Each column consists of a steel channel that is set into and on a base casting. For each three inches of height, there are two holes through the channel to permit bolting the arms in place. All arms are set to a 10-degree angle and turned upward at the end to prevent stock from rolling off. The lowest arms are made short for receiving wooden boards to hold small pieces. Two types of this stock rack are made, the double-arm type illustrated and a single-arm or wall type on which the arms project from one side.

* * *

Never before in the history of the country has labor-saving equipment been installed in such quantities as in recent years. Restriction of immigration has created a scarcity of cheap labor, and American mechanical ingenuity has met this by designing automatic machinery. The net result is a higher earning power on the part of the workers, and hence greater purchasing power.—*Business Bulletin, La Salle Extension University*

NEW MACHINERY AND TOOLS NOTES

Draw-cut Shaper: Mesta Machine Co., Pittsburg, Pa. A heavy-duty draw-cut shaper in which the number of moving parts has been reduced to a minimum, reversing clutches, spline shafts, belts and pulleys having been replaced by direct-acting electrical equipment. A reversing motor delivers the drive to the machine through a single worm reduction. The stroke of the ram and the feed and traverse motions are controlled electrically. Quiet operation and simplicity of design are two features particularly stressed. The normal stroke of the machine is 100 inches, and the extreme stroke 120 inches. The bed is 26 feet long.

Inclinable Presses: Marshalltown Mfg. Co., Marshalltown, Iowa. A line of open-back inclinable power presses made in both flywheel and geared types. The machines have ample die space to permit the use of leader-in die sets and sub-dies. The shafts are extended to permit attaching a crank for any type of automatic feed. There are five sizes, the weight of the smallest machine being 800 pounds, and that of the largest, 5200 pounds.

Crank Shapers: Western Machine Tool Works, Holland, Mich. The complete line of Steptoe improved crank shapers built by this concern is now equipped with Timken tapered roller bearings. This line of shapers ranges in size from 14 to 24 inches inclusive.

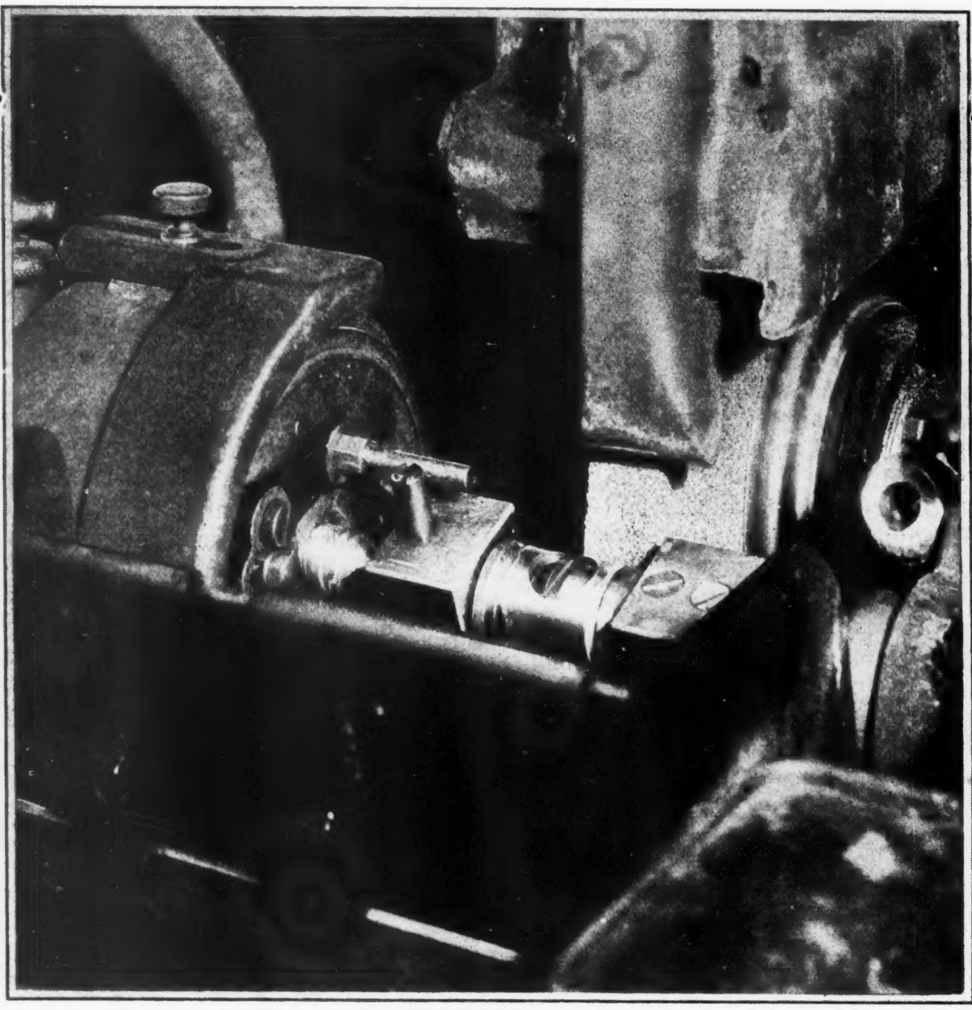
* * *

NEW MOTION PICTURE ON RIVETING

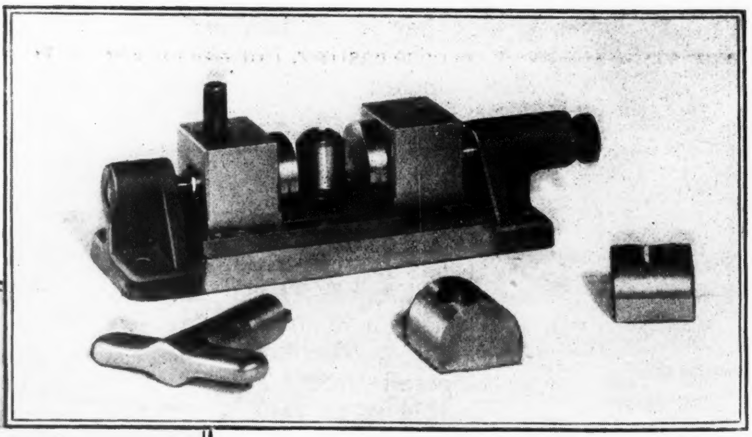
A new motion picture film entitled "This is the Age of Riveted Steel" has been produced by the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. The film illustrates in detail the production of rivets, steel building, and bridge fabrication, the building of railroad equipment, automotive chassis frame production, boiler manufacture, etc. The picture tells a complete story of the rivet's contribution to the progress and safety of humanity. Our nation's greatest battleships; bridges flung across broad rivers, among them the Delaware River, Hell Gate, Chicago's double-deck bridge, and America's longest bridge—the Carquinez; riveted steel skyscrapers; the world's finest railroad equipment are all included. The picture is available without cost to technical societies, clubs, universities, schools, industrial and railroad shops, and to all interested in the art of riveting.

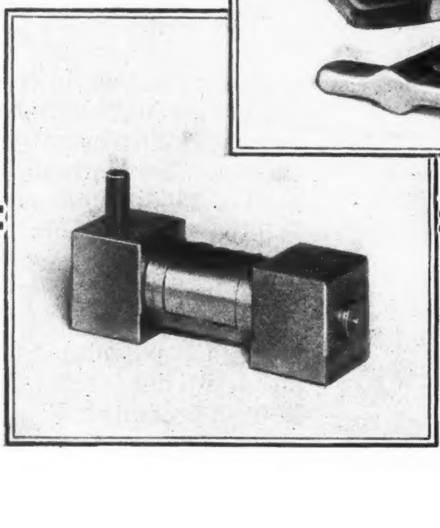
* * *

Pressures used in boilers are going still higher. An article in *The Engineer* describes a new high-pressure boiler constructed by Sulzer Fréres, Winterthur, Switzerland, for which a working pressure of 1565 pounds gage pressure per square inch is used. With steam generated at this pressure, and taking advantage of modern regenerative and reheating cycles, it is stated that a turbine plant can compete with the internal combustion engine, even in small units. The boiler consists of two steam raising units, one a low-pressure and one a high-pressure. The high-pressure drum and steam collector drums are forged from solid ingots, the ends being closed in after the forgings have been machined both on the inside and the outside. The material is a 5 per cent nickel-steel.



Right—It being necessary to grind the diameter of the piece accurately with regard to the center of the hole, and at right angles to the end surfaces, the piece is placed in the holding fixture, which is shown in the centering device, and is located accurately by the pressure of the centers. A turn of the central screw locks the piece in position.





Left—The holding fixture with the piece locked in place, removed from the centering or loading fixture and ready to be mounted between centers in the machine. Two holding fixtures are used—a piece is mounted in one while the piece in the other is being ground.

ONE-HUNDREDTH ANNIVERSARY OF THE JOSEPH DIXON CRUCIBLE CO.

The Joseph Dixon Crucible Co., Jersey City, N. J., manufacturer of graphite products, celebrates its one-hundredth anniversary this year. It was in 1827 that Joseph Dixon started a business in Salem, Mass., to manufacture articles from graphite. He was a man with an inquiring, searching mind. His first invention was a machine for cutting files. Then turning to printing, and finding it necessary to make his type and engravings of wood, he soon became skilled in wood carving. After this, came experiments in making metals for type, and this aroused his interest in developing a crucible capable of withstanding the heats required in this work.

G. T. Smith, Pres., Jos. Dixon Crucible Co.

It was thus that he started in the graphite crucible business, and from that time until the present day the company's growth and development has centered about the same raw material—graphite. Practically all the products of the company today contain graphite, the only exceptions being rubber erasers, belt dressings, and some of the crayons. It was a perfectly logical outcome for the business to develop not only into a leading business in the manufacture of graphite crucibles, but one of the world's largest manufacturers of pencils, graphite lubricants, and protective paints containing graphite.

Joseph Dixon's attention was first directed to graphite by the discovery of this mineral on a New Hampshire farm, but realizing that this supply was neither large enough in quantity nor perfect enough in quality, he arranged with sea captains who were sailing to the Far East to stop at Ceylon on their return trips and pick up a small tonnage of graphite for his use.

The business continued to grow throughout the lifetime of Joseph Dixon, who died in 1869. Subsequent developments, however, proved that he had built his business on a firm foundation and that he had brought into it men who could carry it on toward further achievements. The second great epoch in the history of the business was under the leadership of E. F. C. Young as president, and John A. Walker as vice-president and treasurer. Mr. Walker passed away in 1907, and upon the death of Mr. Young in 1908, George T. Smith succeeded to the presidency. Under his administration, the company has developed into the large well-known business that now is celebrating its one-hundredth anniversary. Associated with Mr. Smith in the management of the business are J. H. Schermerhorn, vice-president; Harry Dailey, secretary; and William Koester, treasurer.

* * *

THE MOTOR BUS INDUSTRY IS GROWING

Ten years ago the motor bus was nothing but an uncertain experiment, considered suitable only for a limited field in city transportation. Today, it reaches out to practically every town and village in the United States and has created an entirely new means of efficient inter-urban transportation. The beginning of 1927 found 75,000 motor buses in use. The investment in motor bus transportation means reaches $500,000,000. This new means of transportation has developed to such an extent that it has become a serious competitor, as well as a very satisfactory adjunct, to the steam and electric railway transportation systems.

It is estimated that the total passenger mileage of buses exceeded 15,000,000,000, and that the revenue exceeded $600,000,000 in 1926. The average revenue per passenger mile was estimated at 4 cents, and the average revenue per bus mile at 32 cents. About 300,000 miles of highway are covered by regular bus lines.

A large number of buses are now used in country districts for carrying school children to and from school; many of the farming districts maintain centrally located high schools to which the children are carried by bus from an extensive surrounding area. The aspect of country life, particularly in the large farming states, has been entirely changed by the bus, no less than by the automobile.

TRADE NOTES

H. O. Swoboda, Inc., consulting electrical and mechanical engineers, have moved to 3400 Forbes St., Pittsburg, Pa.

Standard Electrical Tool Co., 1936 W. 8th St., Cincinnati, Ohio, has appointed Arthur A. Eakins, 12 Pearl St., Boston, Mass., district representative of the company.

Brown Instrument Co., 4418 Wayne Ave., Philadelphia, Pa., announces the opening of a Cincinnati branch at 718 First National Bank Bldg., Cincinnati, Ohio. J. R. Green is district manager.

American Flexible Shaft Mfg. Corporation and the Pneumelectric Corporation, formerly located at 120 Broadway, New York City, have removed their executive offices to 331 Madison Ave.

Simonds Saw & Steel Co., Fitchburg, Mass., has purchased the plants and business of the Abrasive Co. of Philadelphia, Pa., manufacturer of "Borolon" and "Electrolon" grinding wheels, abrasive cloths and papers.

National Automatic Tool Co., Richmond, Ind., announces that it will start selling direct in the Detroit territory on June 14, opening offices in the General Motors Bldg., and being represented by T. C. McDonald and G. W. Schepman.

Will-Burt Co., Orrville, Ohio, manufacturer of power plant equipment, is erecting an addition to the company's plant. The new building, which is of brick and steel construction, 50 by 62 feet, will be used as an addition to the machine shop.

Cincinnati Electrical Tool Co., 2674 Madison Road, Cincinnati, Ohio, has removed its Philadelphia office to larger quarters at 716 N. 16th St. The removal from the restricted district also affords customers ample room for parking trucks while waiting for tools.

Taylor & Fenn Co., Hartford, Conn., announces that Neff, Kohlbusch & Bissel, Inc., 1045 W. Washington Blvd., Chicago, Ill., will represent the Taylor & Fenn Co. in the Chicago and Milwaukee territories, handling all their lines—drilling machines, spline milling machines, vertical milling machines, presses, and grinders.

Air Reduction Co., Inc., 342 Madison Ave., New York City, has acquired the Interstate Oxygen Co., a West Virginia corporation with oxygen plants at Wheeling, W. Va., Steubenville, Ohio, and Portsmouth, Ohio; and the Compressed Gas Mfg. Co., also a West Virginia corporation, having an acetylene plant at Huntington, W. Va.

J. R. Shays, Jr., Inc., 100 Greenwich St., New York City, has been appointed representative of the American High-speed Chain Co., of Indianapolis, Ind., and will handle the sales of that company for the entire eastern district. The Shays organization also represents the Foote Bros. Gear & Machine Co. and the Pyott Foundry Co., both of Chicago.

Link-Belt Ltd., Eastern Ave. and Leslie St., Toronto, Canada, announces that it has awarded a contract to the Jackson-Lewis Co., Ltd., of Toronto, for the construction of a new plant. The company has purchased five acres of land and has started a building program. The unit now in course of construction consists of a two-story brick building, 80 by 160 feet.

Federal Machine & Welder Co., Warren, Ohio, is adding a new section to the company's factory. The addition covers 10,000 square feet, and is of modern glass and steel construction. When completed, it will give the plant a total manufacturing floor area of 32,000 square feet, in addition to an office building covering 5000 square feet of floor space.

Timken Roller Bearing Co., Canton, Ohio, announces that at the annual meeting of the company in April the present officers were re-elected for another year: H. H. Timken is president; W. R. Timken, J. G. Obermier, Marcus T. Lothrop, H. J. Porter, and T. V. Buckwalter are vice-presidents; J. F. Strough is secretary and treasurer; and W. A. Brooks is assistant secretary.

Samuel C. Rogers & Co., 10-16 Lock St., Buffalo, N. Y., have just moved into their new plant at 191-205 Dutton Ave., Buffalo, N. Y. After forty years of continuous operation with an expanding business, it became necessary to increase production facilities. The new factory is equipped with the latest machinery for the manufacture of the company's complete line of automatic knife grinders and band and circular saw sharpeners.

An Unusual Machinery Service

Experienced machinery engineers give nation-wide service from twenty cities. They are ready to help with your special equipment problems. Call on them.

Improved machine tools; metal working equipment of all kinds; special machinery for many lines of industry, and the hundreds of small tools needed in every shop, all are bought through this one dependable source.

For the Machine Shop

"C" Clamps
Chucks
Grinders
Hack Saws
Horizontal Drills
Lathes
Milling Machines
Planers
Portable Electric Drills
Radial Drills
Sensitive Drills
Shapers
Taps
Vises, Machinists'

For the Structural Shop

Air Compressors
Angle Benders
Beam Benders
Column Facers
Combination Punch & Shear
Coping & Notching Machines
Friction Saws
Hoists
Pneumatic Tools
Punches
Reamers
Rivet Forges
Riveters, Yoke
Shears
Wall Radial Drills

For the Railroad Shop

Flue Shop Equipment
Friction Saws
Hammers
Lathes
Punches & Shears
Radial Drills
Rail Drills
Rail Reclamation Equipment
Shapers
Spring Shop Equipment
Staybolt Headers
Staybolt Taps
Tube Expanders
Welding Equipment
Wheel Presses

For the Plate Shop

Air Compressors
Arc Welders
Bending Brakes
Bending Rolls
Bevel Shears
Boiler Shop Radial Drills
Circle Shears
Flanging Clamp
Friction Saws
Pipe Threaders
Planers
Presses
Punches
Riveters
Shears
Spot Welders

For the Sheet Metal Shop

Beaders
Bending Brakes
Circle Shears
Corrugated Sheet Shear
Crimpers
Flanging Machine
Flaring Tools
Folders
Groovers
Knurling Tool
Presses
Punches
Rotary Shears
Serpentine Shears
Slip Rolls
Snips
Spot Welders
Squaring Shears
Stake Riveters
Vises
Wiring Machine

For General Manufacture

Machine Tools,
Small Tools and General Metal Working Equipment of All Kinds.

JOSEPH T RYERSON & SON INC.

Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Pittsburgh, Philadelphia, Boston, Jersey City, New York, Richmond, Houston, Tulsa, Los Angeles, San Francisco, Denver, Minneapolis, Duluth.

RYERSON MACHINERY

Brandes-Merrick Machinery Co., Keith Bldg., Cleveland, Ohio, is a new company organized by F. A. Brandes of the Brandes Machinery Co., Cleveland, Ohio, and E. H. Merrick, for ten years district manager of Manning, Maxwell & Moore's Cincinnati and Cleveland offices. The new company will conduct a general machine tool business, handling both new and used machine tools, as well as cranes, hoists, and welding equipment.

Massillon Power Shovel Co., Massillon, Ohio, has acquired the plant and business of the Massillon Foundry & Machine Co., as well as the Power Shovel Division of Russell & Co., both of Massillon. The Massillon Power Shovel Co. will manufacture the Massillon power shovel and the full line of Massillon steam hammers, bored hammers, and allied products formerly manufactured by the Massillon Foundry & Machine Co.

Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, Ohio, has appointed the firm of J. B. McCarthy and W. P. Robinson representatives of the company in Canada, with offices at 307 Reford Bldg., Toronto, Canada, and 808 Drummond Building, Montreal, Canada. The company has also appointed the Petroleum Electric Co., 217 E. Archer St., Tulsa, Okla., its representative in Oklahoma and the Pan Handle District of Texas.

C. J. Tagliabue Mfg. Co., 18 Thirty-third St., Brooklyn, N. Y., maker of industrial instruments, has opened a branch factory at 5902 Carnegie Ave., Cleveland, Ohio. The prime function of the new factory will be repair work, and special attention will be given to emergency orders. In addition to repair facilities, there will be maintained stocks of all standardized instruments. The Cleveland factory will be in charge of the district manager A. R. Anderson. F. A. Denz, F. L. Frock, and F. Cramer have been assigned to special work at the new branch.

Box Crane & Hoist Corporation, Trenton Ave., E. Ontario, and Tioga Sts., Philadelphia, Pa., has established the following sales connections: Gray Foundry, Inc., Poultney, Vt.; F. R. Quigley, 1402 Lexington Bldg., Baltimore, Md.; Maintenance Engineering Co., 2000 Harrington St., Houston, Tex.; Spencer & Morris, 430 E. 3rd St., Los Angeles, Cal.; R. E. Condit, Dayton, Ohio; W. J. Laufenburg, Kansas City, Mo.; W. F. Moody & Co., Little Rock, Ark.; St. Louis Structural Steel Co., 1217 Syndicate Trust Bldg., St. Louis, Mo.; McNeely Equipment Co., 707 Guaranty Bldg., Indianapolis, Ind.; J. F. Bruce, 1017 Engineers Bldg., Cleveland, Ohio.

Stockbridge Machine Co., Worcester, Mass., announces a reorganization of the company. John W. Harrington has been made president and treasurer, and Leon J. Barrett general manager. Mr. Harrington is treasurer of the Harrington & Richardson Arms Co. and president of the Heald Machine Co. Mr. Barrett is proprietor of the Leon J. Barrett Co. Mr. Beaman, formerly treasurer and manager, has retired to start a new company to manufacture the "Quick Sharp" knife grinder formerly made by the Stockbridge Machine Co. No change in the location of the plant will be made, but the office will be removed to the plant of the Leon J. Barrett Co. on Grafton Road.

Reed-Prentice Corporation, Worcester, Mass., has completed agency arrangements with the following Pacific Coast machinery dealers, to represent the company's line of machine tool equipment, including Reed-Prentice lathes, radial drills, Becker vertical millers, Whitcomb planers, etc.; Shaw-Palmer-Bakewell Co., Los Angeles, Cal.; Flanagan Machinery Co., San Francisco, Cal.; and F. A. Daley Co., Portland, Ore. The company has also made arrangements with the following Pacific Coast representatives to sell the Wolf portable link sawing machine: Shaw-Palmer-Bakewell Co., Los Angeles, Cal.; A. L. Young Machinery Co., San Francisco, Cal.; and P. Sinnock & Co., Portland, Ore.

Prest-O-Lite Co., 30 E. Forty-second St., New York City, announces the sale of the storage battery branch of its business to a new company, the Prest-O-Lite Storage Battery Corporation. The entire capital stock of the new company is owned by the Automotive Battery Corporation of New York. That part of the Indianapolis plant of the Prest-O-Lite Co. used for the manufacture of storage batteries has been leased to the new company. However, the Prest-O-Lite Co. will continue the manufacture and sale of acetylene gas for use in the oxy-acetylene process of welding and cutting metals, automobile lighting, lead burning, etc., as well as the manufacture of gas cylinders, acetylene generators, and similar apparatus.

Metals Coating Co. of America, 497 N. 3rd St., Philadelphia, Pa., at the annual meeting of the stockholders elected the following directors to serve for the ensuing year: Richard L. Binder, George Ruck, E. Waring Wilson, Bernhard Rickenback, James H. Gravell, Rudolph H. Schroeder, Karl E. Kluegmann, and E. Heinzerling. Mr. Heinzerling is the newly elected member of the board, the other seven directors having been re-elected. At the organization meeting of the board of directors held on the same day, the following officers were re-elected for the ensuing year: Richard L. Binder, president; Rudolph H. Schroeder, vice-president; George Ruck, vice-president; E. Waring Wilson, treasurer; and J. C. Merkel, secretary. It was stated at the annual meeting that arrangements have been made for operating a branch plant in Prague, Czecho-slovakia, in addition to the present plants in Philadelphia, Berlin, and Hamburg, and for distribution rights for metal-coating equipment in the British Empire in conjunction with the present English company.

Manning, Maxwell & Moore, Inc., New York City, have acquired the entire line of heavy machine tools formerly manufactured by the Detrick & Harvey Machine Co. of Baltimore, Md., and the Beaman & Smith line of milling machines and special production machines formerly manufactured at Providence, R. I., which lines Manning, Maxwell & Moore, Inc., will develop and manufacture at the plant of the Putnam Machine Co., Fitchburg, Mass. This extensive program necessitates that Manning, Maxwell & Moore, Inc., devote their entire selling efforts to their own lines, and therefore, they are discontinuing the sale of machine tools for other manufacturers with the exceptions noted below. Their branch offices at Birmingham, Philadelphia, Buffalo, Boston, and Cleveland will be closed, but direct representatives will be located in these territories to conduct sales and service of Putnam machines and the products of the Shaw crane plant. The Chicago office will be continued under the management of R. S. Dean, and in that territory a selected line of machine tools will be handled, in addition to the products of the Putnam and Shaw plants. In the Pittsburg territory, Norman Allderdice, formerly sales manager for Manning, Maxwell & Moore, Inc., has organized a machine selling company to be known as the Arch Machinery Co. This company will act as sales agent for the products of the Putnam Machine Co. and in certain areas for the products of the Shaw Crane Works. Both manufacturing and sales operations of the Putnam and Shaw plants will be under the direction of Frank J. Baumis, who is vice-president of Manning, Maxwell & Moore, Inc., and president of the Putnam Machine Co. Joseph Wainwright will be general manager of machinery sales, and W. B. Clarke will be general sales manager of crane sales. Manning, Maxwell & Moore, Inc., will continue to act as exclusive sales agent in the railroad field for the Monarch Machine Tool Co. and the Amplex Machinery Co. The Ashcroft-Hancock-Consolidated and other steam specialties manufacturing and sales activities of Manning, Maxwell & Moore, Inc., are in no way affected by these changes.

* * *

An interesting development in the machinery manufacturing field that is worthy of more than casual note is the appointment by Gerard Swope, president of the National Electrical Manufacturers' Association, of a committee of seven executives from prominent electrical concerns to investigate the situation regarding patents in the electrical industry, in order to determine whether some modification of the plan utilized by the National Automobile Chamber of Commerce may not be made applicable to the electrical manufacturing industry.

* * *

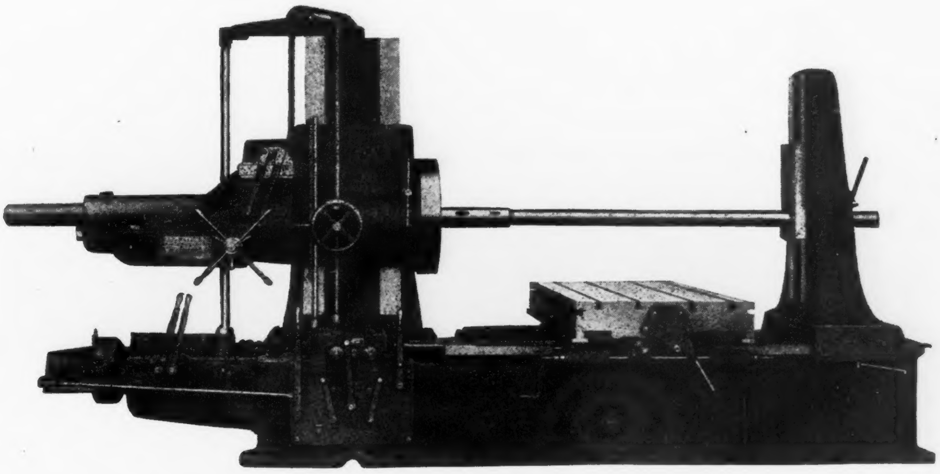
The one-hundred thirtieth anniversary of Waynesboro, Pa., well known in the machine tool industry as the home of the Landis Machine Co., maker of threading machinery, and the Landis Tool Co., maker of grinding machinery, was recently commemorated by a special edition of the Waynesboro *Record Herald*, which carried a rotogravure section showing principal buildings, scenes of interest, factories, and Waynesboro products.

NEW, LARGER SIZES

of the

LUCAS "PRECISION"

Horizontal Boring, Drilling and Milling Machine



NO. 43 MACHINE WITH 5 INCH SPINDLE

No. 42 size has a 4 inch diameter spindle

Circular B-2, pertaining to these larger size machines, describes the various improved features, which anticipate the demands to be made in production, experimental and tool room work. You will find it interesting, if you will send for it.

If a smaller machine would be more suitable for your work, ask for Circular A-37, describing the No. 31 Machine with 3-inch spindle.

THE LUCAS MACHINE TOOL CO., Cleveland, Ohio, U.S.A.

FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry, Societe Anonyme Belge, Alfred Herbert, Brussels. Allied Machinery Co., Turin, Barcelona, Zurich. V. Lowener, Copenhagen, Oslo, Stockholm. R. S. Stokvis & Zonen, Paris and Rotterdam. Andrews & George Co., Tokyo. Ing. M. Kocian & G. Nedela, Prague. Schuchardt & Schutte, Berlin.

PERSONALS

E. J. Ashley, master mechanic of the Steele & Johnson Mfg. Co., Waterbury, Conn., has been appointed general superintendent of the company.

Robert T. Kent, until recently superintendent of Prison Industries, State of New York, has been appointed general manager of the Bridgeport Brass Co., Bridgeport, Conn.

Ross L. McLellan, formerly managing director of the Compania Westinghouse Electric Internacional S. A., has been appointed general manager of the Westinghouse Electric International Co. with headquarters in New York City. Mr. McLellan has been connected with the Westinghouse organization since 1915, having joined the Chicago branch of the company as a salesman in railway work. In 1921 he was sent to Santiago, Chile, to contract on behalf of the company for the electrification of the Chilian State Railways, and in 1923 he was sent to Europe in connection with railway electrification. In 1924 he was made managing director of the Compania Westinghouse Electric Internacional S. A., making his headquarters in Buenos Aires, Argentine Republic. Mr. McLellan has recently arrived in New York from Buenos Aires to assume his new position.

Ross L. McLellan

G. A. Gunther has been placed in charge of the Chain Belt Co.'s Buffalo office, to take the place of T. E. Cocker who has been put in charge of the Cleveland territory.

G. E. Wearn has been appointed central station sales manager of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa. Mr. Wearn will be located in New York City.

John H. Glover, representative of the Cone Automatic Machine Co., Goss & DeLeeuw Machine Co. and the W. Gaterman Mfg. Co., has removed from 2120 N. Menard Ave., Chicago, Ill., to 2127 N. Sayre Ave., Chicago.

H. C. Thomas has been appointed assistant general manager of the merchandising department of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa. Mr. Thomas was formerly assistant to the manager of the merchandising department.

Gustaf A. Englund, factory manager of the Jacobs Mfg. Co., Hartford, Conn., sailed for Europe on the SS. *Gripsholm* May 14. Mr. Englund will stay in Europe three months, combining vacation with business, and will visit Sweden, Norway, and Germany.

Fred E. Holtz has been appointed representative in the Milwaukee territory of the William Ganschow Co., of Chicago and Peoria, Ill. The division headquarters will be located at 1246 Twenty-fourth Ave., Milwaukee. Mr. Holtz will be assisted by Oscar E. Rosche.

E. R. Wyler, who has been connected with the Cleveland, Ohio, sales branch of the Independent Pneumatic Tool Co., has been transferred to the sales department of the general offices of the company, at 600 W. Jackson Blvd., Chicago, Ill. Mr. Wyler will make his headquarters in St. Paul, Minn.

Oscar Erlandson, formerly with the R. D. King Co., Chicago, Ill., maker of the King pressure toggle, has joined the sales force of the V. & O. Press Co., Hudson, N. Y., which has acquired the patents and good will of the R. D. King Co. Mr. Erlandson's address will be Hotel Madison, Detroit, Mich.

W. O. Forman, until recently mechanical superintendent of the Boston and Maine Railroad, has entered the service of Manning, Maxwell & Moore, Inc., as assistant to the vice-president, Frank J. Baumis. For the present he will specialize in factory operation and methods at the Putnam and Shaw factories of Manning, Maxwell & Moore, Inc.

Stewart M. Bunting, who has been connected with the Smith Booth Usher Co., Los Angeles, Cal., for some time, has left the employ of this company. Mr. Bunting was formerly manager of the miscellaneous department of the Niles-Bement-Pond Co. He has made no plans as yet for the immediate future, but will probably return East shortly.

B. L. Morgan, for many years connected with the Perry-Fay Co., Elyria, Ohio, as superintendent, and for nineteen years with the Western Automatic Machine Screw Co., has recently become associated with the U. S. Automatic Co., Amherst, Ohio, where he will serve in the capacity of general superintendent. Altogether, Mr. Morgan has been identified with the screw products manufacturing field for the last forty years.

Charles O. Watson, formerly manager of the Buffalo office of Manning, Maxwell & Moore, Inc., has been appointed direct factory representative east of Pittsburg for the Kempsmith Mfg. Co., of Milwaukee, Wis. A. C. Nieman, one of the former salesmen of the Kempsmith Mfg. Co., has been appointed factory representative of the company with headquarters at Cleveland, Ohio. Both representatives will act as sales engineers for Kempsmith dealers.

Royal D. Malm has been appointed western district sales manager, with headquarters at Chicago, of the Lincoln Electric Co., Cleveland, Ohio. Mr. Malm graduated from the Case School for Applied Science in 1912 and for four years after leaving school was engaged in construction engineering. He then became identified with the Elyria Iron & Steel Co., later becoming connected with the standard welding division of the Standard Parts Corporation, as general superintendent. For the last year Mr. Malm has had charge of Lincoln sales in the automotive industries, with headquarters in Detroit, Mich.

Royal D. Malm

H. A. Couse, a member of the law department of the General Electric Co., Schenectady, N. Y., has been appointed general counsel of the incandescent lamp department with offices at 120 Broadway, New York City. Philip D. Reed will be associated with Mr. Couse at his New York office. F. H. Babcock, of the central station department, has been designated assistant to Charles W. Appleton, who was recently elected vice-president in charge of general relations with public utilities.

J. P. Alexander has been appointed Boston manager of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., in charge of all sales and service in New England. Mr. Alexander has been associated with the Westinghouse organization for the last twenty years and has become a prominent figure in the electrical industry in New England. George H. Cox, who has been New England manager for the last eight years, has been appointed sales manager at the South Philadelphia Westinghouse Works.

E. A. Muller, president of the King Machine Tool Co., Cincinnati, Ohio, and J. T. Faig, president of the Ohio Mechanics Institute, were given a testimonial dinner, Saturday, May 21, at the Cincinnati Club, by the Cincinnati Local Section of the American Society of Mechanical Engineers, in recognition of their many services to the society. Mr. Muller is a member of the Council of the A. S. M. E. and Professor Faig is chairman of the committee on education and training for the industries. Over eighty members and guests were present, including many leading Cincinnati machine tool manufacturers and engineers. Dr Hollis, past-president of the A. S. M. E., made the principal address.

William A. Rockenfield, for the last twelve years general manager of the Baldwin Chain & Mfg. Co., Worcester, Mass., has resigned his position, with a view to taking a complete rest for several months before again entering active business. His plans for future activities have not yet been announced. Mr. Rockenfield gained his first general manufacturing and business experience with the Link-Belt Co., at the Indianapolis plant of that concern. Later he became one of the incorporators of the American High Speed Chain Co., and in 1915 he went to the Baldwin Chain & Mfg. Co. During the period that he has been general manager of this company, its plant facilities have been greatly increased and a new modern plant has been erected. Mr. Rockenfield is also chairman of the board of the Joy Machine Co., Franklin, Pa., builder of coal mining machinery.

COMING EVENTS

JUNE 6-8—Annual convention of the American Association of Engineers at Tulsa, Okla. Acting secretary, M. E. McIver, 63 E. Adams St., Chicago, Ill.

JUNE 6-9—Annual convention of the American Foundrymen's Association to be held at Edgewater Beach Hotel, Chicago. No exhibition of equipment will be held this year in conjunction with the convention. C. E. Hoyt, executive secretary, 140 S. Dearborn St., Chicago, Ill.

JUNE 7-9—Annual meeting of the Mechanical Division of the American Railway Association at Windsor Hotel, Montreal, Quebec. There will be no exhibits of railway appliances or machinery this year. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

JUNE 13-17—Twenty-second annual convention of the National Supply and Machinery Distributors' Association in conjunction with the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association, on board the Steamship *Noronic*, leaving Detroit June 13 and returning June 17. George A. Fernley, secretary, 505 Arch St., Philadelphia, Pa.

JUNE 13-18—Exposition of the Association of Iron and Steel Electrical Engineers at the Syria Mosque, Pittsburg, Pa. General chairman, John F. Kelly, 705 Empire Bldg., Pittsburg.

JUNE 20-24—Annual meeting of the American Society for Testing Materials at French Lick Springs, Ind. Secretary's address, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.

AUGUST 31-SEPTEMBER 2—Annual convention of the American Railway Tool Foremen's Association at the Hotel Sherman, Chicago, Ill. G. G. Macina, secretary, 11402 Calumet Ave., Chicago, Ill.

AUGUST 31-SEPTEMBER 2—First Steel and Power Show in the new Varsity Arena, Toronto, Canada. This exhibition is sponsored by the Montreal and Toronto Chapters of the American Society for Steel Treating; the Canada, Toronto, and Hamilton Councils of the Universal Craftsmen's Council of Engineers; the Toronto, Hamilton, and Dominion Executive of the Engineers Mutual Benefit Fund, and the Toronto Branch of the American Electro-platers' Society. General chairman of the exhibition, C. Bradshaw, 153 University Ave., Toronto, Canada.

SEPTEMBER 7-9—Seventh annual New Haven machine tool exhibition to be held in New Haven, Conn. Harry R. Westcott, Chairman Exhibition Committee, 400 Temple St., New Haven, Conn.

SEPTEMBER 19-23—National Machine Tool Builders' Association Exposition to be held in Cleveland, Ohio, under the direction of the association. For further information, address National Machine Tool Builders' Exposition Manager, Room 635, 1328 Broadway, New York City.

SEPTEMBER 19-23—Ninth annual convention and exposition of the American Society for Steel Treating to be held in Convention Hall, Detroit, Mich. For further information, address W. H. Eisenman, National Secretary, 4600 Prospect Ave., Cleveland, Ohio.

SEPTEMBER 26-OCTOBER 1—Eleventh annual exposition of chemical industries in the Grand Central Palace, New York City. For further information address Publicity Department, Exposition of Chemical Industries, Grand Central Palace, New York, N. Y.

SOCIETIES, SCHOOLS AND COLLEGES

OHIO MECHANICS INSTITUTE, Central Parkway and Walnut St., Cincinnati, Ohio. Circular announcing the summer session, which opens June 20 and closes July 29.

NEW BOOKS AND PAMPHLETS

STANDARDS YEAR BOOK (1927). 392 pages, 6 by 9 inches. Published by the Department of Commerce, Washington, D. C., as Miscellaneous Publication No. 77 of the Bureau of Standards. Price, $1.

THERMAL EXPANSION OF GRAPHITE. By Peter Hidnert and W. T. Sweeney. 8 pages, 7 by 10 inches. Published by the Department of Commerce, Washington, D. C., as Technologic Paper of the Bureau of Standards No. 335. Price, 5 cents.

MANUAL OF ENDURANCE OF METALS UNDER REPEATED STRESS. By H. F. Moore. 61 pages, 5 by 7½ inches. Published by the Engineering Foundation, Engineering Societies Building, 29 W. 39th St., New York City. Price, $1.

This little book contains the results of a research on the fatigue of metals conducted by Professor H. F. Moore at the University of Illinois under the auspices of the National Research Council and the Engineering Foundation in cooperation with several important industries. The research covered a period of several years and was carried on by a score or more of investigators.

ESSENTIALS OF METAL WORKING. By Edward Berg and Bristol E. Wing. 159 pages, 5¼ by 8 inches. Published by the Manual Arts Press, Peoria, Ill. Price $1.32, postpaid.

This little book is intended to serve as a textbook for schools and shop, in connection with the teaching of the specialized branches of metal-working, such as machine shop practice, forging, and tinsmithing. The authors are instructors in the Washington High School, Milwaukee, Wis., and have therefore learned through practical experience the requirements for a work of this kind. The text covers the tools and fundamental practices common to many metal-working activities, such as tools for measuring and laying out; tools for cutting and shaping metals; and tools for holding, adjusting, and assembling. In addition, related matter pertaining to the production, characteristics, and manipulation of common metals is included.

ORGANIZING THE DRAFTING DEPARTMENT. By H. F. Church. 133 pages, 6 by 8½ inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $3.50.

Most of the books relating to drafting practice have been intended for the craftsman rather than the executive. The present book discusses the organizing of a drafting department, the purpose being to outline a plan of organization and familiarize the executive with sufficient operating data to enable him to check up on the management of the department after it has been organized. An idea of the treatment of the subject will be obtained from the following list of chapter headings: Analyzing Drafting Needs; Setting Up the Organization; Selecting and Training Personnel; Planning and Equipping the Drafting Department; Drafting Equipment and Materials; Systematizing the Drafting Department; Increasing Output; and Mechanical Reproduction.

HENLEY'S TWENTIETH CENTURY BOOK OF RECIPES, FORMULAS, AND PROCESSES. Edited by Gardner D. Hiscox. 809 pages, 5½ by 8¾ inches. Published by the Norman W. Henley Publishing Co., 2 W. 45th St., New York City. Price, $4.

This is a revised and enlarged edition of a well-known compilation of recipes, formulas, and processes. It contains over 10,000 recipes, covering a very wide field, applicable in the home, the factory, and the work-shop. The new edition contains many new formulas as well as a chapter on laboratory methods which should assist the experimenter in compounding the various recipes. Naturally, old recipes and so-called "trade secrets" that have proved their value by long use are included, but the primary aim has been to modernize and bring the entire work up to date. An idea of the wide field covered will be obtained by a list of a few of the sections of the book: Alloys; Aluminum and its Treatment; Antidotes for Poison; Cheese; Chicken Diseases and Their Remedies; Cleaning Preparations and Methods; Dyes; Eye Lotions; Glass; Hair Preparations; Household Formulas; Paints; Photography; Plating; Steel; Vulcanization of Rubber; Watchmakers' Formulas, etc.

VACATIONS FOR INDUSTRIAL WORKERS. By Charles M. Mills. 328 pages, 6 by 8½ inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price $5.

This volume begins a series of research studies on human relations in industry by Industrial Relations Counsellors, Inc. In this book, for the first time, is presented a comprehensive treatment of the subject of vacations for industrial workers throughout the world. The book contains the results of a survey on present practice as regards vacations both in this country and abroad. The first part of the book deals with the general vacation movement; the second part with the vacation movement in the United States; and the third part, with the vacation movement in countries outside of the United States. The results of the survey indicate a more extensive application of the practice of paying wages during vacation than was expected. The survey seeks to answer the following questions in a general way: What has been the historical development of the vacation movement? What are the main provisions in plans of individual companies, collective agreements, or legislations? What are the social and economical results of the vacation movement?

NEW CATALOGUES AND CIRCULARS

BLOWERS. American Blower Co., Detroit, Mich. Bulletin 1033, descriptive of "Sirocco" blowers for domestic oil burners.

ELECTRIC FITTINGS. Crouse-Hinds Co., Syracuse, N. Y. Circular illustrating some of the many styles of Obround condulets made by this concern.

GEARS. W. A. Jones Foundry & Machine Co., 4409 W. Roosevelt Road, Chicago, Ill. Second edition of catalogue 26, on spur gear speed reducers.

LIGHTING EQUIPMENT. Edison Lamp Works of General Electric Co., Harrison, N. J. Bulletin LD-155 containing definitions of various illumination terms.

POWER HOES (Drag Scrapers). Link-Belt Co., 300 W. Pershing Road, Chicago, Ill. Book 666, illustrating the use of power hoes, or drag scrapers, in handling sand, gravel, or coal.

GAGES. Comtor Co., Waltham, Mass. Circular illustrating and describing the Comtor system and gages for production and inspection measurement of outside and inside machine diameters.

GRINDING WHEEL STANDS. Norton Co., Worcester, Mass. Circular illustrating and describing Norton grinding wheel stands with motor in the base. Specifications for the different sizes are included.

ELECTRIC FURNACE STEEL CASTINGS. Lebanon Steel Foundry, Lebanon, Pa. This bulletin—the fifteenth of a series on the subject of electric furnace steel castings—discusses the cleaning department.

PULLEYS. Pyott Foundry Co., 328 N. Sangamon St., Chicago, Ill. Series of folders treating of this company's line of products, which consists of cast-iron pulleys—their application, advantages, etc.

LIFT-TRUCK PLATFORMS. Barrett-Cravens Co., 1326 W. Monroe St., Chicago, Ill. Catalogue covering the Barrett-Cravens line of "Steeleg" platforms, including special types for special applications.

ELECTRIC DRILLS, GRINDERS, AND BUFFERS. Standard Electrical Tool Co., 1936 W. 8th St., Cincinnati, Ohio. Folder illustrating Standard portable electric tools, including drills, grinders, and buffers.

"ANOTHER AJAX" Installation at Nash Motors Company

"Another Ajax" is a slogan which could aptly be applied to Ajax Upsetting Forging Machines in automobile plants because of their decided prevalence. Nash Motors Company are noted for their conservative farsighted policies. In their purchases of production machinery, they have had an eye not only to production range and capacity, but also to durability and slow obsolescence. Their initial judgment on Ajax Machines has been frequently substantiated by subsequent orders.

401 Ajax Hot Metal Working Machines, including Upsetting Forging Machines, Hot Sawing and Burring Machines, Bolt and Rivet Headers, Forging Rolls, Slow Speed and High Speed Bulldozers in the plants of automobile and accessory manufacturers are undisputable evidence of their wholehearted endorsement by the automobile industry.

If you are interested in any production machines of the above types, we will be pleased to forward you complete descriptive literature and submit estimated outputs on your particular work.

THE AJAX MANUFACTURING COMPANY
EUCLID BRANCH P. O., CLEVELAND, OHIO

621 Marquette Bldg.
CHICAGO, ILL.

1360 Hudson Terminal
NEW YORK CITY

AJAX

NICKEL-CHROMIUM STEEL. International Nickel Co., Inc., 67 Wall St., New York City. Bulletin 10 of a series on nickel steel, treating of chrome-nickel steel in special track work.

DRILLING MACHINES. Adolph Muehlmatt, S. E. Cor. 5th and Elm Sts., Cincinnati, Ohio. Booklet C, entitled "An Outline of Economical Small Drilling," illustrating and describing the A. M. sensitive drilling machine.

SCREWDRIVERS. Husky Wrench Co., Milwaukee, Wis. Loose-leaf bulletin announcing new Husky units for 1927, including the No. 155 socket screwdriver set, the No. 156 screwdriver bit set, adapters, and new Husky sockets.

GEARS. Charles Bond Co., 617 Arch St., Philadelphia, Pa. Catalogue 52, listing Bond standard stock gears, as well as a complete line of roller chain and sprockets and other products such as gear reducers, universal joints, ball bearings, couplings, etc.

INDUSTRIAL TRUCKS. Standard Pressed Steel Co., Box 20, Jenkintown, Pa. Bulletin descriptive of the "Hallowell" steel lift truck platforms, which are made in three different styles—types H, S, and W—as licensed under U. S. Patent 1,575,462.

LIGHTING EQUIPMENT. Cooper Hewitt Electric Co., 95 River St., Hoboken, N. J. Catalogue 500, descriptive of Cooper Hewitt work-light for industrial lighting. The illustrations show installations of Cooper Hewitt lighting in a variety of plants.

PAINT SPRAY OUTFIT. Hobart Bros. Co., Troy, Ohio. Circular illustrating and describing the HB portable paint spray outfit, which consists of a paint spraying outfit mounted on a truck so that it can be conveniently moved to any required place in the shop.

COLUMN FACING MACHINES. Newton Works of the Consolidated Machine Tool Corporation of America, Rochester, N. Y. Bulletin 115, illustrating and describing Newton type T column facing machines, especially designed for facing the ends of beams and columns.

HEAT-TREATING EQUIPMENT. Bristol Co., Waterbury, Conn. Bulletin 358, containing information on the installation and care of pyrometers, which is intended to serve as a guide to the users of Bristol thermo-electric pyrometers in securing the greatest efficiency.

DROP-FORGED TOOLS. J. H. Williams & Co., Buffalo, N. Y. General catalogue of drop-forgings and drop-forged tools, including wrenches, pipe tongs, tool-holders, lathe dogs, clamps, nuts, screws, eyebolts, handles, connecting-rods, etc. The catalogue gives complete specifications including prices.

ELECTRIC FURNACES. Ajax Electrothermic Corporation, Division of Ajax Metal Co., Trenton, N. J. Circular dealing with the quantity production of steel in the Ajax-Northrup high-frequency furnace. Particular attention is called to the speed of melting that is possible with these large-capacity furnaces.

STEEL. Crucible Steel Co. of America, 17 E. 42nd St., New York City. Booklet of HYCC (How You Cut Costs) steel. This pamphlet is intended for tool steel users who have long-run production problems. The illustrations and record shown give an idea of results that may be attained by using HYCC steel.

ELECTRIC HOISTS. Shepard Electric Crane & Hoist Co., 382 Schuyler Ave., Montour Falls, N. Y. Bulletin 71-A, illustrating and describing the Shepard line of floor-operated electric hoists. The illustrations show the different types and the application of each type to the class of work for which it is particularly adapted.

HEAT-TREATING EQUIPMENT. Stanley P. Rockwell Co., 66 Trumbull St., Hartford, Conn. Bulletin 2704, descriptive of the Rockwell dilatometer for tempering and annealing operations. Typical curves made by the dilatometer in tempering tool steel, high-speed steel, and in annealing and normalizing metals are reproduced.

ELECTRICAL EQUIPMENT. General Electric Co., Schenectady, N. Y. Loose-leaf circulars GEA-6, GEA-250, GEA-530A, GEA-570, and GEA-753, illustrating and describing, respectively, squirrel-cage motors, drum-type control equipment, type MT control equipment for crane hoist motors, hand starting compensators, and shoe-type solenoid brakes.

FLEXIBLE SHAFTING. Stow Mfg. Co., Inc., Binghamton, N. Y., has just issued engineering sheets and catalogue combined, in loose-leaf form, 9 by 12 inches, on flexible shafting. The catalogue contains illustrations and descriptions of self-contained motor-driven units for grinding, drilling, buffing, polishing, sanding, and metal and wood finishing. Much space has been devoted to equipment especially designed for steel mills and electric railways.

VERTICAL TURRET LATHE. Bullard Machine Tool Co., Bridgeport, Conn. Circular illustrating and describing the 64-inch "Spiral Drive" type vertical turret lathe described in February MACHINERY, page 472, where one of the machines in the new "Spiral Drive" line was also illustrated. The 64-inch machine has twelve table speeds, ranging from 2.5 to 43 R.P.M., takes work 66 inches in diameter and has a height of 33 3/4 inches under the cross-rail and 48 inches under the turret face. The vertical head has a movement of 27 inches; the side-head has a vertical movement of 29 inches and a horizontal movement of 24 inches. There are eight positive and independent feed changes for each head.

REDUCING FIRE HAZARDS BY ROLLER BEARINGS

An article in the *Lumbermen's Underwriting Alliance Bulletin* calls attention to the fact that several serious fires in woodworking plants and saw mills have been caused by overheated bearings. The article, prepared by W. Robert McMurray, one of the inspectors of the Alliance, advocates the use of roller bearings to replace the ordinary babbitted bearings, because of the elimination of danger from overheated bearings and the reduced fire risk. In this connection, the author of the article points out that, while the first cost of a babbitted bearing is much less than that of a roller bearing, the advantages in the long run are greatly in favor of the roller type. Several examples are quoted showing how the power required for driving equipment has been greatly reduced by the use of roller bearings.

In one case, Timken bearings were installed on a Yates resaw which formerly, using babbitted bearings, had required 94 horsepower to operate. The power consumption was reduced to 35 horsepower when roller bearings were used. Generally speaking, the author states that he finds that the substitution of roller bearings for babbitted bearings has saved, on an average, 50 per cent in power. At the plant of the Eureka Cedar Lumber & Shingle Co. in the state of Washington, the cost of lubrication has been reduced by 75 per cent through the installation of roller bearings. In addition, there is the great advantage due to the reduction of fire risk, especially in woodworking plants.

Hot boxes, according to the article quoted, are the most common causes of fires in saw mills. The largest saw mill loss ever suffered in the Pacific Northwest was caused by a hot box, the loss amounting to over $1,000,000. A roller bearing is not entirely free from the danger of becoming hot, but the chance of fire is so much less that the roller bearing is winning the favor of the insurance companies. Should a roller bearing not receive the proper amount of lubrication, the bearing will simply "freeze" on the shaft and the belt will be thrown off the pulley, without creating sufficient heat to cause ignition of any inflammable materials. Thus there is less danger of fire when roller bearings are used.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

of MACHINERY, published monthly at New York, N. Y., for April 1, 1927.

State of New York }
County of New York } ss.

Before me, a Notary Public, in and for the state and county aforesaid, personally appeared Edgar A. Becker, who, having been duly sworn according to law, deposes and says that he is the treasurer of the Industrial Press, Publishers of MACHINERY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Industrial Press, 140-148 Lafayette St., New York; Editor, Erik Oberg, 140-148 Lafayette St., New York; Managing Editor, None; Business Managers, Alexander Luchars, President, 140-148 Lafayette St., New York, and Robert B. Luchars, Vice-president, 140-148 Lafayette St., New York.

2. That the owners of 1 per cent or more of the total amount of stock are: The Industrial Press; Alexander Luchars; Alexander Luchars, Trustee for Helen L. Ketchum, Elizabeth Y. Urban, and Robert B. Luchars; Nellie I. O'Neill; Louis Pelletier; and Erik Oberg. The address of all the foregoing is 140-148 Lafayette St., New York.

3. That there are no bondholders, mortgagees, or other security holders.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 22nd day of March, 1927

CHARLES P. ABEL,

(SEAL) Notary Public, Kings County No. 153
Kings Register No. 7006
New York County No. 49. New York Register No. 7082
(My commission expires March 30, 1927.)